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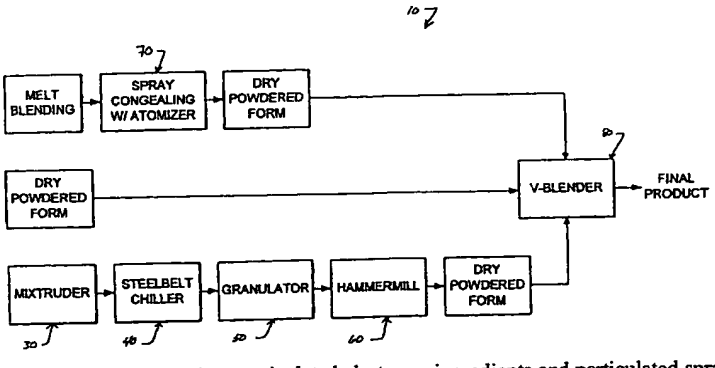

(57) Abstract: A particulated gum base comprises particulated elastomer ingredients and particulated spray congealed ingredients having a size of less than or equal to about 1 mm. A method of making a particulate blend gum base comprises the steps of providing at least one first gum base ingredient having a softening point of less than about 130 °C, providing a second gum base ingredient, combining at least the first and second gum base ingredients to form a combined ingredient having a particulate form, blending at room temperature the combined ingredient with a third gum base ingredient to form the powder blend gum base, the powder blend gum base comprising at least an elastomer, a softener, an antitack ingredient and a filler. An improved method for making chewing gum products and gum base products. A method of preventing agglomeration of particulate gum base products. A remotely controlled method of making a particulate blend gum base. A method of making chewing gum products and gum base products having improved consistency from one batch to the next. An improved method for making gum base products having reduced changeover costs from the manufacture of one product to the next. An imporved method of making gum base products using the same equipment having reduced contamination from one formulation to the next. An improved method of making gum base products having temperature sensitive ingredients. An improved method of making chewing gum products using reduced temperatures. An improved method of making a batch of chewing gum. A method of making a gum and wrapping gum products without conditioning.

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GUM BASE AND GUM MANUFACTURING USING PARTICULATED GUM BASE INGREDIENTS

CROSS REFERENCE TO EARLIER FILED APPLICATIONS

The present application is a continuation-in-part of Application Serial No. 09/520,872 filed March 8, 2000, which claims the benefit of the filing date under 35 U.S.C. §119(e) of provisional Application Serial No. 60/125,314 filed March 19, 1999, both of which are hereby incorporated by reference.

BACKGROUND OF THE INVENTION

The present invention relates to a novel process for making a particulate blend gum base and the final gum product.

Conventionally, it has been impractical to use the same optimum conditions for manufacturing gum base and for manufacturing gum products from gum base and other ingredients such as sweeteners and flavors. For instance, conventional gum base manufacture typically involves the dispersive (often with shear) mixing of difficult-to-blend ingredients such as elastomer, filler, elastomer plasticizers, base softeners/emulsifiers and, sometimes wax and typically requires long mixing times. Conventional gum product manufacture involves combining the gum base with more delicate ingredients such as product softeners, bulk sweeteners, high intensity sweeteners and flavoring agents using distributive mixing, for shorter periods.

Gum base is typically manufactured and then shipped to chewing gum manufacturers who blend it with various ingredients to formulate the commercial gum product.

Typically, the manufacture of conventional chewing gum base involves adding gum base ingredients, either separately or simultaneously, into a heated sigma-blade, twin-screw or continuous mixer. The gum base ingredients often must be size reduced either by shredding or crushing, to obtain the desired quantity for a batch of bum base and to feed the ingredients into the mixer. Conventional chewing gum base includes one or

more elastomers, one or more fillers, plasticizers and, optionally, polymers, waxes, emulsifiers and miscellaneous colors, flavors, sweeteners, and anti-oxidants. Gum base manufacture is typically a tedious and time-consuming process primarily due to the difficulty in melting and dispersing the elastomers homogeneously among the other gum base ingredients. In preparing gum base, it is important that the elastomeric portion be thoroughly mixed with the other components, which are included in the base composition to effect various characteristics of the resulting gum composition, so that the entire gum base product will retain proper resiliency as a homogeneous phase. In the mixer, the gum base ingredients are melted and mixed together to form a homogenous molten mixture. The melted mix at times is blended, or compounded. The compounding of conventional gum base typically requires 20 minutes or longer in the presence of high heat, typically between about about 150° F. and about 250° F., and shear. As the mixture is compounded, the plasticizers and, optionally, softeners reduce the molecular weight of the elastomers. This results in a final gum base product that has a more uniform consistency and is free of lumps and other irregularities. In conventional gum base manufacture, the more uniform the gum base product is before it is added to the gum making process, the more uniform and homogenous the final gum product will be. After compounding, the hot viscous melt is passed through a filter to remove any foreign materials or impurities.

Cooling and solidifying the hot viscous gum base for shipment and storage presents further processing problems and also requires expensive machinery and time-consuming handling techniques. The hot viscous melt can be pan-molded or extruded into blocks, or as pellets packed in plastic lined cartons or sealed in containers. The molds, however, may require an anti-sticking coating and considerable hand labor to clean the molds for reuse. In addition, to formulate the blocks or slabs of gum base into gum compositions, the blocks must be broken into small particles by milling or crushing before they may be admitted to a blender for processing into gum compositions.

In the alternative, the hot viscous melt may be pelletized. From the filter, the hot viscous material falls into a receptacle and when required, is cooled to obtain a viscosity suitable to put it in solid form. When the molten gum base has been cooled to a form retaining temperature of around 140° F, it is conveyed to a pelletizer. The pelletizer forms varying sizes of pellets from the gum melt by extruding the gum melt through the die. The pellets may proceed to a tumbler where a dusting agent, for example, calcium carbonate or talc powder is applied to the pellets to prevent adhesion, agglomeration, and the like, before the pelleted gum base is eventually used in the production of chewing gum. However, in spite of the individual powder coating and sealed containers, the pellets may still tend to agglomerate.

Several factors such as vibration during shipment, the pressure within the container due to the depth of product and temperature promote agglomeration. For this reason, it is common to limit the size or height of the containers and/or refrigerate the pellets at a temperature not to exceed 41° F.

The powder coating used to minimize agglomeration can present further manufacturing problems. For instance, seasonal changes must be taken into account in varying the proportions of powder utilized as a coating. Also, the powder must uniformly coat the gum base pellets. A non-uniform coating, settlement of the powder during shipment or the sudden release of powder left behind at any point of handling may lead to variations in the powder concentration and cause difficulty in formulating the end product.

When used to make gum compositions, the pelleted gum base is melted and mixed with the other gum ingredients. The molten gum composition is extruded into slab form, fed through a series of rollers to reduce the slab to the thickness of a gum stick and scored. The scored gum is then placed into a conditioning room at a temperature of about 55° F. to about 70° F., at 50% relative humidity for about 8 to about 24 hours. Thereafter, the gum sticks are wrapped.

It is believed that the exposure of the gum base, and subsequent gum composition, to the processing conditions imparted by the manufacture of conventional gum base, and conventional gum composition, contributes to the

need to temper, or condition, conventional gum compositions before the final gum product is wrapped.

It is a general object of the present invention to provide an improved method for making chewing gum products and gum base products.

It is a general object of the present invention to provide methods of preventing agglomeration of particulate blend gum base products.

It is a general object of the present invention to minimize the manufacturing costs resulting from the changeover from one gum base to another.

It is a general object of the present invention to provide a remotely controlled method of making a particulate blend gum base.

It is a general object of the present invention to provide a method of making chewing gum products and gum base products having improved consistency from one batch to the next.

It is a general object of the present invention to provide an improved method of making gum base products using the same equipment having reduced contamination from one formulation to the next.

It is a general object of the present invention to provide an improved method of making gum base products having temperature sensitive ingredients.

It is a general object of the present invention to provide an improved method of making chewing gum products having temperature sensitive ingredients.

It is a general object of the present invention to provide a method of making chewing gum products using reduced temperatures.

It is a general object of the present invention to provide an improved method of making a batch of gum.

It is a general object of the present invention to provide an improved method of making a gum and wrapping gum products without conditioning.

BRIEF SUMMARY OF THE INVENTION

In a first aspect, the invention is a method of making a particulate blend gum base comprising the steps of: providing at least one first gum base ingredient having a softening point of less than about 130° F.; providing a second gum base ingredient; combining said at least one first and second gum base ingredients to form a combined ingredient having a particulated, free-flowing form; blending the combined ingredient at a temperature in the range of about 40°F to about 90°F with at least a third gum base ingredient to form the particulate blend gum base, said particulate blend base comprising at least an elastomer, a softener, an antitack ingredient, and a filler.

In a second aspect, the invention is a method of making a particulate blend gum base that uses soft elastomers comprising the steps of: melting a soft elastomer and an elastomer plasticizer together to form a homogeneous molten mixture; cooling and processing the homogenous molten mixture to form a solid mixture in a particulated state; and blending the particulated soft elastomer/elastomer plasticizer with other gum base ingredients to form said gum base.

In a third aspect, the invention is a method of making a particulate blend gum base that uses at least one soft elastomer comprising the steps of: melting at least one soft elastomer and at least one polyvinyl acetate together to form a homogeneous molten mixture; cooling and processing the homogenous molten mixture to form a solid mixture in a particulated state; and blending the particulated soft elastomer/polyvinyl acetate with other gum base ingredients to form said particulate blend gum base.

In a fourth aspect, the invention is a method of making a particulate blend gum base comprising: providing a fat and a wax; mixing the fat and the wax together in a molten state; cooling the fat and wax blend and forming a particulate material; and blending the fat and wax particulate material with other particulated gum base ingredients to form the particulate blend gum base.

In a fifth aspect, the invention is a method of combining a fat and wax to form an ingredient that can be used to make a particulate blend gum base

comprising the steps of: providing a fat selected from the group consisting of fully saturated oils that contain, as one or more of their constituent groups, fatty acids of carbon chain length of from 6 to 18 and triglycerides having a total summated saturated caprioic, caprylic, capric, lauric, myristic and palmitic fatty acid content of from about 8 to about 60 percent by weight of the fatty acids, determined from the fatty acid methyl ester distribution by gas chromatography; providing a wax selected from the group consisting of petroleum waxes containing predominantly iso-alkanes having a carbon chain lengths greater than about 30, and synthetic waxes; melting the fat and wax together to form a melted fat and wax blend; cooling the melted fat and wax blend to form a particulated gum base ingredient.

In a sixth aspect, the invention is a method of preparing a particulate blend gum base comprising the steps of: melting a gum base ingredient; spraying the melted gum base ingredient through an atomizing nozzle and cooling the ingredient to form a solid, particulated gum base ingredient; and blending the particulated gum base ingredient with other particulated gum base ingredients to form the particulate blend gum base.

In a seventh aspect, the invention is a method of making a particulate blend gum base comprising the steps of: blending two or more gum base ingredients together in a liquid form to form a combined ingredient; said combined ingredient having a viscosity of less than 80,000 centipoises at about 250° F.; solidifying the combined ingredient in a particulated form; and blending the particulated combined ingredient with at least one other gum base ingredient to form the particulated blend gum base.

In an eighth aspect, the invention is a method of making a particulate blend gum base comprising the steps of: providing a first gum base ingredient having a softening point greater than 130°F; providing a second gum base ingredient; melting and blending said at least first gum base ingredient with said second gum base ingredient to form a combined ingredient having a liquid form; spraying said combined ingredient to form an atomized spray; hardening said atomized spray to form a combined ingredient that is then used to make said particulated blend gum base.

In a ninth aspect, the invention is a method of making a particulate gum base comprising the steps of: providing a first gum base ingredient that has viscosity greater than about 80,000 centipoises at 250°F; providing a second gum base ingredient; blending and melting said at least said first and second gum base ingredients to form a combined ingredient having a viscosity less than about 80,000 centipoises at 250°F.; spraying said combined ingredient to form an atomized spray; hardening said atomized spray to form an ingredient that is then used to make said particulate blend gum base.

In a tenth aspect, the invention is a method of preventing agglomeration of one or more particulate gum base ingredients comprising the steps of: providing a plurality of particulate gum base ingredients; blending the plurality of particulate gum base ingredients; and adding an anti-caking agent to the blend of particulate gum base ingredients at a level sufficient to prevent the blend of particulate gum base from agglomerating when left unagitated at a temperature of at least 58° F. for a period of at least about 48 hours.

In a eleventh aspect, the invention is a method of preventing agglomeration of one or more particulate gum base ingredients comprising the steps of: providing a plurality of particulate gum base ingredients; blending the plurality of particulate gum base ingredients; and agitating the blend of particulate gum base ingredients until just prior to the addition of the blend of particulate gum base ingredients to a gum mixer.

In a twelfth aspect, the invention is a method of manufacturing gum base so as to have a high degree of consistency from one batch to the next comprising the steps of: a) providing gum base ingredients in a particulate form; b) particulate blending the gum base ingredients together without forming a molten gum base to form a first batch of particulate blend gum base; said first batch of particulate blend gum base having a first ash content, a first antioxidant content and a first softening point; repeating steps a) and b) to form a second batch of particulate blend gum base; said second batch of particulate blend gum base having a second ash content, a second

antioxidant content and a second softening point; wherein said first ash content and said second ash content have a variation of about 5% or less.

In a thirteenth aspect, the invention is a method of manufacturing a first gum base having a first composition and subsequently manufacturing a second gum base having a second composition, using the same equipment and minimizing the amount of the first composition carried over into the second composition between the manufacture of the first gum base and the second gum base comprising the steps of: providing a plurality of first gum base ingredients in particulate form; providing a plurality of second gum base ingredients in particulate form; adding the plurality of first gum base ingredients to a mixer, particulate blending the plurality of first gum base ingredients to form a particulate blend of first gum base ingredients and emptying the particulate blend of first gum base ingredients out of the mixer; said mixer retaining a residual amount of first gum base ingredients of less than about 1% of the volume of the mixer; and adding the plurality of second gum base ingredients to the mixer and powder blending the ingredients to form the second gum base.

In a fourteenth aspect, the invention is a method of making a particulate gum base from a plurality of gum base ingredients in a particulate form comprising the steps of: providing a plurality of storage compartments each storing at least one of said plurality of gum base ingredients in a particulate form; providing automated controls to allow remote control dispensing of said at least one of said plurality of gum base ingredients in a particulate form from each of said storage compartments; selecting a gum base to be made; remotely activating said controls to dispense a desired amount of each of said at least one of said plurality of gum base ingredients in a particulate form from said plurality of storage compartments; and blending the desired amounts of the plurality of gum base ingredients in particulate form to form a particulate blend gum base.

In a fifteenth aspect, the invention is a method of making a batch of gum comprising the steps of: providing one or more containers that contains pre-weighed amounts of a plurality of gum base ingredients sufficient to form

one batch of gum, the plurality of gum base ingredients being in a particulate form; emptying the entire contents of said one or more containers into a gum mixer; adding additional gum ingredients to the gum mixer sufficient to form one batch of gum; and mixing the gum base ingredients and additional gum ingredients to form a batch of gum.

In a sixteenth aspect, the invention is a method of manufacturing gum comprising the steps of: providing a plurality of particulated gum base ingredients; providing additional gum ingredients; adding a combination of the particulated gum base ingredients to a gum mixer as a particulate blend; the gum mixer having an initial kettle temperate of between about 20° C. and about 40° C.; adding the additional gum ingredients to the mixer; mixing the combination of the particulated gum base ingredients and additional gum ingredients in the gum mixer to form a gum composition.

In a seventeenth aspect, the invention is a method of making a gum composition using reduced temperature comprising the steps of: providing gum base ingredients in a particulate form; adding the particulate gum base ingredients to a gum mixer; adding additional gum ingredients to the mixer and mixing all of the ingredients to form the gum composition, the contents of the mixer not exceeding a temperature of 120° F. throughout the mixing process.

In an eighteenth aspect, the invention is a method of making chewing gum comprising the steps of: providing at least one first gum base ingredient having a softening point of less than about 130° F; providing a second ingredient that is used to make chewing gum; combining at least said first gum base ingredient and said second gum ingredient to form a combined ingredient having a particulated form; and combining the combined ingredient with at least a third gum ingredient to form a chewing gum composition.

In a nineteenth aspect, the invention is a method of making a chewing gum composition that contains a temperature sensitive ingredient comprising: providing a particulate blend gum base; adding the particulate blend gum base to a gum mixer; adding other gum ingredients, including said temperature sensitive ingredient, to the gum mixer and mixing the ingredients

to form a chewing gum composition, the temperature sensitive ingredient being mixed into the other ingredients earlier in the mixing process than when the temperature sensitive ingredient is conventionally mixed into the chewing gum composition made using a melted gum base.

In a twentieth aspect, the invention is a method of making a gum composition that contains a temperature sensitive ingredient comprising: providing a particulate blend gum base; adding the particulate blend gum base to a gum mixer; adding other gum ingredients, including said temperature sensitive ingredient, to the gum mixer and mixing the ingredients, including said temperature sensitive ingredient, for a period of time to form a gum composition; said period of time being shorter than the period of time required to mix a conventional gum composition using a melted gum base.

In a twenty first aspect, the invention is a method of making a gum composition that contains a temperature sensitive ingredient comprising: providing a particulate blend gum base; adding the particulate blend gum base to a gum mixer; adding other gum ingredients, including said temperature sensitive ingredient, to the gum mixer and mixing the ingredients including said temperature sensitive ingredient, to form a gum composition; the temperature sensitive ingredient being mixed into the other ingredients with the initial addition of gum ingredients in the mixing process.

In a twenty second aspect, the invention is a method of making a gum composition using reduced temperature comprising the steps of: providing gum base ingredients in a particulate blend form; adding the particulate blend gum base ingredients to a gum mixer having an initial kettle temperature of between about 20° C. and about 40° C.; adding additional gum ingredients to the mixer and mixing all of the ingredients to form the gum composition.

In a twenty third aspect, the invention is a method of making a gum composition and wrapping gum products made therefrom without the need to condition the gum composition prior to wrapping, comprising the steps of: using a particulate blend gum base to make a gum composition; forming the gum composition into gum sticks; and wrapping the products without conditioning the gum sticks.

In a twenty fourth aspect, the invention is an improved method of making a gum composition wherein the improvement comprises using a gum base in a particulate blend form and mixing the gum for less time than would be used to make the same gum composition using a gum base having the same composition as the particulate blend but in a melted state.

These and other advantages of the invention will be best understood in view of the attached drawings.

BRIEF DESCRIPTION OF SEVERAL VIEWS OF THE DRAWINGS

Figure 1 is a flow chart of the schematic drawing of a preferred process of making a gum base in particulate form according to the pilot plant of the present invention.

Figure 2 is a schematic drawing of a preferred process of making a gum base in particulate form according to the present invention.

Figure 3 is a schematic drawing of the mixtruder for use with the present invention.

Figure 4 is a schematic drawing of the steelbelt chiller used in a preferred process of the present invention.

Figure 5 is a schematic drawing of the granulator used in a preferred process of the present invention.

Figure 6 is a schematic drawing of the hammermill used in a preferred process of the present invention.

Figure 7 is a schematic drawing of the atomizer used in a preferred process of the present invention.

Figure 8 is a schematic drawing of the v-blender used in a preferred process of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Unless noted otherwise, all percentages herein are by weight percent.

The present invention is applicable to preparing a gum base and final gum products and can be used with either a batch-type system or a continuous extruder-type system. In the preferred embodiment of the present

invention, however, and for ease in illustrating the present invention, it will be described herein with reference to its use in a partially-continuous gum base pilot plant, manufacturing process.

Schematic illustrations of the preferred process for making a particulated gum base and apparatus for use with the present invention are illustrated in FIGS. 1 – 8.

In general, a chewing gum composition typically comprises a water-soluble bulk portion, a water-insoluble chewable gum base portion and typically water-insoluble flavoring agents. The water-soluble portion dissipates with a portion of the flavoring agent over a period of time during chewing. The gum base portion is retained in the mouth throughout the chew.

The insoluble gum base generally comprises elastomers, resins, fats and oils, waxes, softeners and inorganic fillers. Elastomers may include polyisobutylene, isobutylene-isoprene copolymer and styrene butadiene elastomer, as well as natural latexes such as chicle. Resins include polyvinylacetate and terpene resins. Fats and oils may also be included in the gum base, including tallow, hydrogenated and partially hydrogenated vegetable oils, and cocoa butter. Commonly employed waxes include paraffin, microcrystalline and natural waxes such as beeswax and carnauba. According to the preferred embodiment of the present invention, the insoluble gum base constitutes between about 5% and about 95% by weight of the gum. More preferably the insoluble gum base comprises between about 10% and about 50% by weight of the gum, and most preferably between about 20% and about 45% by weight of the gum. When high levels of gum coatings are needed, gum base may comprise up to 95% of the gum center formula.

The gum base typically also includes a filler component. The filler component may be calcium carbonate, magnesium carbonate, talc, dicalcium phosphate or the like. The filler may constitute between about 5% and about 60% by weight of the gum base. Preferably, the filler comprises about 5% to about 50% by weight of the gum base.

Gum bases typically also contain softeners, including glycerol monostearate and glycerol triacetate. Further, gum bases may also contain

optional ingredients such as antioxidants, colors, and emulsifiers. The present invention contemplates employing any commercially acceptable gum base.

The water-soluble portion of the chewing gum may further comprise softeners, sweeteners, flavoring agents and combinations thereof. Softeners are added to the chewing gum in order to optimize the chewability and mouth feel of the gum. Softeners, also known in the art as plasticizers or plasticizing agents, generally constitute between about 0.5% and about 15% by weight of the chewing gum. Softeners contemplated by the present invention include glycerin, lecithin and combinations thereof. Further, aqueous sweetener solutions such as those containing sorbitol, hydrogenated starch hydrolyzates, corn syrup and combinations thereof may be used as softeners and binding agents in gum.

Sugar sweeteners generally include saccharide-containing components commonly known in the chewing gum art which comprise, but are not limited to, sucrose, dextrose, maltose, dextrin, dried invert sugar, fructose, levulose, galactose, corn syrup solids and the like, alone or in any combination. Sugarless sweeteners include components with sweetening characteristics but which are devoid of the commonly known sugars and comprise, but are not limited to, sugar alcohols such as sorbitol, mannitol, xylitol, hydrogenated starch hydrolyzates, maltitol and the like, alone or in any combination.

A flavoring agent may also be present in the chewing gum in an amount within the range of from about 0.1% to about 10%, preferably from about 0.5% to about 5%, by weight of the gum. The flavoring agents may comprise essential oils, synthetic flavors, or mixtures thereof including, but not limited to oils derived from plants and fruits such as citrus oils, fruit essences, peppermint oil, spearmint oil, clove oil, oil of wintergreen, anise, and the like. Artificial flavoring components are also contemplated for use in gums of the present invention. Those skilled in the art will recognize that natural and artificial flavoring agents may be combined in any sensorally acceptable blend. All such flavors and flavor blends are contemplated by the present invention.

Optional ingredients such as colors, emulsifiers and other active agents may be added to the chewing gum.

In general, chewing gum is manufactured by sequentially adding the various chewing gum ingredients to a commercially available mixer known in the art. After the ingredients have been thoroughly mixed, the gum mass is discharged from the mixer and shaped into the desired form such as extruding into chunks or casting into pellets, which are then coated or panned.

Generally, the ingredients are mixed by first melting the gum base and adding it to the running mixer. The base may also be melted in the mixer itself. Color or emulsifiers may also be added at this time. A softener such as glycerin may also be added at this time, along with syrup and a portion of the bulking agent. Other optional ingredients are added to the batch in a typical fashion, well known to those of ordinary skill in the art.

The entire mixing procedure typically takes from five to fifteen minutes, but longer mixing times may sometimes be required. Those skilled in the art will recognize that many variations of the above-described procedure may be followed.

By the terms "active agent" the present invention refers to a compound that has a desired therapeutic or physiological effect once ingested and/or metabolized. The therapeutic effect may be one which decreases the growth of a xenobiotic or other gut flora or fauna, alters the activity of an enzyme, provides the physical relief from a malady (*e.g.*, diminishes pain, acid reflux or other discomfort), has an effect on the brain chemistry of molecules that determine mood and behavior. Of course these are just examples of what is intended by therapeutic effect. Those of skill in the art will readily recognize that a particular agent has or is associated with a given therapeutic effect.

The active agent may be any agent that is traditionally used as a medicament and lends itself to being administered through the oral cavity. Such active agents may be vitamins, chemotherapeutics; antimycotics; oral contraceptives, nicotine or nicotine replacement agents, minerals, analgesics, antacids, muscle relaxants, antihistamines, decongestants, anesthetics, antitussives, diuretics, anti-inflammatories, antibiotics, antivirals,

psychotherapeutic agents, anti-diabetic agents and cardiovascular agents, nutraceuticals and nutritional supplements.

Vitamins and co-enzymes that may be delivered using this invention include but are not limited to water or fat soluble vitamins such as thiamin, riboflavin, nicotinic acid, pyridoxine, pantothenic acid, biotin, flavin, choline, inositol and paraminobenzoic acid, carnitine, vitamin C, vitamin D and its analogs, vitamin A and the carotenoids, retinoic acid, vitamin E and vitamin K.

Examples of chemotherapeutics agents include but are not limited to cisplatin (CDDP), procarbazine, mechlorethamine, cyclophosphamide, camptothecin, ifosfamide, melphalan, chlorambucil, bisulfan, nitrosurea, dactinomycin, daunorubicin, doxorubicin, bleomycin, plicomycin, mitomycin, etoposide (VP16), tamoxifen, taxol, transplatinum, 5-fluorouracil, vincristin, vinblastin and methotrexate or any analog or derivative variant thereof.

Antimicrobial agents that may be used include but are not limited to naficillin, oxacillin, vancomycin, clindamycin, erythromycin, trimethoprim-sulphamethoxazole, rifampin, ciprofloxacin, broad spectrum penicillin, amoxicillin, gentamicin, ceftriazoxone, cefotaxime, chloramphenicol, clavunate, sulbactam, probenecid, doxycycline, spectinomycin, cefixime, penicillin G, minocycline, β–lactamase inhibitors; mezlocillin, piperacillin, aztreonam, norfloxacin, trimethoprim, ceftazidime, dapsone.

Antifungal agents that may be delivered include but are not limited to ketoconazole, fluconazole, nystatin, itraconazole, clomitrazole, and amphotericin B. Antiviral agents that may be used include but are not limited to acyclovir, trifluridine, idoxorudine, foscarnet, ganciclovir, zidovudine, dideoxycytosine, dideoxyinosine, stavudine, famciclovir, didanosine, zalcitabine, rifimantadine, and cytokines.

Antacids include cimetidine, ranitidine, nizatidine, famotidine, omeprazole, bismuth antacids, metronidazole antacids, tetracycline antacids, clarthromycin antacids, hydroxides of aluminum, magnesium, sodium bicarbonates, calcium bicarbonate and other carbonates, silicates, and phosphates.

Antihistamines are represented by but are not limited to cimetidine, ranitidine, diphenydramine, prylamine, promethazine, chlorpheniramine, chlorcyclizine, terfenadine, carbinoxamine maleate, clemastine fumarate, diphenhydramine hydrochloride, dimenhydrinate, prilamine maleate, tripelennamine hydrochloride, tripelennamine citrate, chlorpheniramine maleate, brompheniramine maleate, hydroxyzine pamoate, hydroxyzine hydrochloride, cyclizine lactate, cyclizine hydrochloride, meclizine hydrochloride, acrivastine, cetirizine hydrochloride, astemizole, levocabastine hydrochloride, and loratadine.

Decongestants and antitussives include agents such as dextromethorphan, levopropoxyphene napsylate, noscapine, carbetapentane, caramiphen, chlophedianol, pseudoephedrine hydrochloride, diphenhydramine, glaucine, pholcodine, and benzonatate.

Anesthetics include etomidate, ketamine, propofol, and benodiazapines (*e.g.*, chlordiazepoxide, diazepam, clorezepate, halazepam, flurazepam, quazepam, estazolam, triazolam, alprozolm, midazolam, temazepam, oxazepam, lorazepam), benzocaine, dyclonine, bupivacaine, etidocaine, lidocaine, mepivacaine, promoxine, prilocaine, procaine, proparcaine, ropivacaine, tetracaine. Other useful agents may include amobartital, aprobarbital, butabarbital, butalbital mephobarbital, methohexital, pentobarbital, phenobarbital, secobarbital, thiopental, paral, chloral hydrate, ethchlorvynol, clutethimide, methprylon, ethinamate, and meprobamate.

Analgesics, include opioids such as morphine, mepidine, dentanyl, sufentranil, alfentanil, aspirin, acetaminophen, ibuprofen, indomethacine, naproxen, atrin, isocome, midrin, axotal, firinal, phrenilin, ergot and ergot derivatives (wigraine, cafergot, ergostat, ergomar, dihydroergotamine), imitrex.

Diuretics include but are not limited to acetazolamide, dichlorphenamide, methazolamide, furosemide, bumetanide, ethacrynic acid torseimde, azosemide, muzolimine, piretanide, tripamide, bendroflumethiazide, benzthiazide, chlorothiazide, hydrochlorothiazide, hydroflumethiazide, methyclothiazide, polythiazide, trichlormethiazide,

indapamide, metolazone, quinethazone, amiloride, triamterene, sprionolactone, canrenone, and potassium canrenoate.

Anti-inflammatories include but are not limited to salicylic acid derivatives (*e.g.* aspirin) paraminophenol derivative (*e.g.* acetaminophen) indole and indene acetic acids (indomethacin, sulindac and etodalac) heteroaryl acetic acids (tolmetin diclofenac and ketorolac) aryl propionic acid derivatives (ibuprofen, naproxen, ketoprofen, fenopren, oxaprozine), anthranilic acids (mefenamic acid, meclofenamic acid) enolic acids (piroxicam, tenoxicam, phenylbutazone and oxyphenthatrazone).

Psychotherapeutic agents include thorazine, serentil, mellaril, millazine, tindal, permitil, prolixin, trilafon, stelazine, suprazine, taractan, navan, clozaril, haldol, halperon, loxitane, moban, orap, risperdal, alprazolam, chlordiaepoxide, clonezepam, clorezepate, diazepam, halazepam, lorazepam, oxazepam, prazepam, buspirone, elvavil, anafranil, adapin, sinequan, tofranil, surmontil, asendin, norpramin, pertofrane, ludiomil, pamelor, vivactil, prozac, luvox, paxil, zoloft, effexor, wellbutrin, serzone, desyrel, nardil, parnate, eldepryl.

Cardiovascular agents include but are not limited to nitroglycerin, isosorbide dinitrate, sodium nitroprisside, captopril, enalapril, enalaprilat, quinapril, lisinopril, ramipril, losartan, amrinone, lirinone, vesnerinone, hydralazine, nicorandil, prozasin, doxazosin, bunazosin, tamulosin, yohimbine, propanolol, metoprolol, nadolol, atenolol, timolol, esmolol, pindolol, acebutolol, labetalol, phentolamine, carvedilol, bucindolol, verapamil, nifedipine, amlodipine and dobutamine.

It is envisioned that depending on the active agent or medicament, the resultant chewing gum can be used to treat inter alia: coughs, colds, motion sickness; allergies; fevers; pain; inflammation; sore throats; cold sores; migraines; sinus problems; diarrhea; diabetes, gastritis; depression; anxiety, hypertension; angina and other maladies and symptoms. Also these gums may be useful in ameliorating cravings in substance abuse withdrawal. Specific active agents or medicaments include by way of example and limitation: caffeine, aspirin, acetaminophen; ibuprofen; cimetidine, ranitidine,

famotidine, dramamine, omeprazole, dyclonine, chlorpheniramine maleate, pseudoephedrine hydrochloride, dextromethorphan, benzocaine, naproxen, and nicotine.

Compositions that may be formulated into a suitable chewing gum formulation are described in, for examples, U.S. Patent No. 5,858,423; U.S. Patent No. 5,858,413; U.S. Patent No. 5,858,412 and U.S. Patent No. 5,858,383. Additionally, Goodman and Gilman's "The Pharmaceutical Basis of Therapeutics" (Eds. Hardman et al., Publ. McGraw Hill, NY) provides comprehensive guidance of useful drugs and their mechanisms of action. Medicated chewing gums have been particularly effective in the delivery of agents such as nicotine as described in for example, U.S. Patent No. 5,866,179; and U.S. Patent No. 5,889,028. U.S. Patent No. 5,846,557 describes general chewing gum compositions containing cough suppressing agents. These patents are incorporated herein by reference as providing a teaching of the incorporation of medicinal agents into oral chewable formulations.

Nutraceuticals and nutritional supplements may also be added to chewing gums as active agents. Among these are herbs and botanicals that include, but are not limited to capsicum, chamomile, cat's claw, echinacea, garlic, ginger, ginko, various ginseng, green tea, golden seal, kava kava, nettle, passion flower, saw palmetto, St. John's wort, and valerian. Also included are mineral supplements such as calcium, copper, iodine, iron, magnesium, manganese, molybdenum, phosphorous, and selenium. Other nutraceuticals that also can be added to chewing gum as active agents are fructo-oligosaccharides, glucosamine, grapeseed extract, guarana, inulin, phytosterols, phytochemicals, isoflavones, lecithin, lycopene, oligofructose, polyphenol and psyllium as well as weight loss agents such as chromium picolinate and phenylpropanolamine.

Phytochemicals may also be added to chewing gums as active agents. Among these are adhatoda vasica, amla, andrographis paniculata, ashwagandha, asparagus racemosus, bacopa monnierapiper boswellia serrata, calcium sennosides, capsaicin, centella asiaticagarcinia garcinia

indica, coleus forskohlii curcuma longatrigonella foenum, ginger extract, green tea, commiphora mukul gymnema sylvestre, inula racemosa, licorice, momordica charantia morinda citrifolia, mucuna pruriens, neem leaf extract, olive leaf extract, phyllanthus amarus, picrorhiza kurroa, piper longum, rosemary extract, rubia cordifolia, saw palmetto, sida cordifolia, pterocarpus marsupium, soy isoflavones, terminalia arjuna, terminalia belerica, terminalia chebula, tinospora tinospora cordifolia tribulus terrestris, trikatu, triphala, tulsi extract, tyolphora, horse chestnut, yohimbe extract.

For atomizing blends of particulated ingredients and liquid ingredients with base ingredients having viscosities greater than 80,000 centipoise at 250° F., the temperature of blending is dependant on the stability and volatility of the particulated and liquid ingredients. The temperature should be suitable to maintain the integrity and reduce the volatilization of these ingredients as much as possible, and still be within the atomization temperature ranges as set forth in the invention. The particle size of the particulated ingredients is less than 0.6 microns.

Typically, liquid ingredients can be blended with appropriate viscosity ingredients in the range of 0.1 to about 40 percent by weight of the total blending batch. Preferably, the range is from about 0.1 to about 35 percent.

For particulated ingredients, typically the range is from about 0.1 to about 45 percent by weight, and preferably from about 0.1 to about 35 percent.

It should be understood that the chewing gum formulation(s) of the present invention are not limited to the agents listed herein above, indeed any medicinal or other active agent that lends itself to ingestion may be formulated into the chewing gum formulations of the present invention.

The insoluble portion of the gum typically may contain any combination of elastomers, vinyl polymers, elastomer plasticizers, fillers, softeners, waxes and other optional ingredients such as colorants and antioxidants.

The variety of gum base ingredients typically used provides the ability to modify the chewing characteristics of gums made from the gum base.

Elastomers provide the rubbery, cohesive nature to the gum, which varies depending on this ingredient's chemical structure and how it may be compounded with other ingredients.

Natural elastomers may include natural rubber such as smoked or liquid latex and guayule, natural gums such as jelutong, lechi caspi perillo, massaranduba balata, massaranduba chocolate, nispero, rosidinha, chicle, gutta percha, gutta kataiu, niger gutta, tenu, chilte, chiquibul, gutta hang kang. Synthetic elastomers may include high molecular weight elastomers such as butadiene-styrene copolymers and isobutylene-isoprene copolymers, low to high molecular weight elastomers such as polybutadiene and polyisobutylene, vinyl polymeric elastomers such as polyvinyl acetate, polyethylene, vinyl copolymeric elastomers such as vinyl acetate/vinyl laurate, vinyl acetate/vinyl stearate, ethylene/vinyl acetate, polyvinyl alcohol or mixtures thereof.

Hard elastomers are elastomers that have Mooney viscosities of greater than 30. Common hard elastomers include isoprene-isobutylene elastomer, often called butyl elastomer; butadiene-styrene type elastomer, often called SBR; and polyisobutylene (PIB) elastomers of average GPC molecular weights greater than 75,000.

Butadiene-styrene type elastomers typically are copolymers of from about 20:80 to 60:40 styrene:butadiene monomers. The ratio of these monomers effects the elasticity of the SBR as evaluated as Mooney viscosity. As the styrene: butadiene ratio decreases, the Mooney viscosity decreases. Typical Mooney viscosities for these elastomers are from about 40 to 80 ML1 + 3 @ 210ºF.

Isobutylene-isoprene type elastomers have molar percent levels of isoprene ranging from 0.2 to 4.0. Typical Mooney viscosities for these elastomers range from 30 to 75 ML1+8 @ 250º F. The average molecular weights of these elastomers may range from 200,000 to 1,000,000.

The structure of SBR typically consists of straight chain 1,3-butadiene copolymerized with phenylethylene (styrene). The structure of butyl elastomer typically consists of branched 2-methyl-1,3-butadiene (isoprene) copolymerized with 2-methylpropene (isobutylene).

Polyisobutylene type elastomers are polymers of 2-methylpropene. These elastomers provide soft chew characteristics to the gum base and still provide the elastic qualities, as do the other elastomers. Average molecular weights may range from about 30,000 to 120,000. PIB having GPC average molecular weights greater than and equal to 75,000, for the purpose of the present invention, are hard elastomers. Those PIB's with GPC average MW less than 75,000 are, for the purposes of the present invention, soft elastomers.

Polybutenes range in average molecular weights from about 5,000 to less than about 30,000.

Vinyl polymeric and copolymeric type elastomers provide tack resistance, vary the chew characteristics of gums made from these bases and offer hydrophilic properties beneficial to sensory perception of the final gums.

For copolymeric types, the amount of vinyl laurate, vinyl stearate, or ethylene present in the vinyl laurate/vinyl acetate (VL/VA), vinyl stearate/vinyl acetate (VS/VA), or ethylene/vinyl acetate (EVA) copolymers respectively typically ranges from about 10 to about 60 percent by weight of the copolymer. Average molecular weights of these polymers may range from about 2,000 to about 80,000. Ball and ring softening points of these polymers may range from about to 50 to 120ºC. Polyvinyl acetate having an average molecular weight from about 8,000 to about 52,000 are preferred for use in the gum base and gum of the present invention. More preferred for chewing gum bases are those of from about 10,000 to about 35,000 molecular weight, and for bubble gum bases, those having from about 30,000 to about 60,000 molecular weight.

Vinyl polymers typically release flavor quickly, and using iso-alkanic waxes exhibiting small crystalline structure with these vinyl polymers extends flavor release.

Petroleum waxes aid in the curing of the finished gum made from the gum base as well as improve shelf-life and texture. Wax crystal size when hard also improves the release of flavor. Those waxes high in iso-alkanes have a smaller crystal size than those waxes high in normal-alkanes,

especially those with normal-alkanes of carbon numbers less than 30. The smaller crystal size allows slower release of flavor since there is more hindrance of the flavor's escape from this wax versus a wax having larger crystal sizes.

Fats may be selcted from the group comprising fully saturated oils that contain, as one or more of their constituent groups, fatty acids of carbon chain length of from 6 to 18 and triglycerides having a total summated saturated caprioic, caprylic, capric, lauric, myristic and palmitic fatty acid content of from about 8 to about 60 percent by weight of the fatty acids, determined from the fatty acid methyl ester distribution by gas chromatography.

Waxes may be selected from the group consisting of petroleum waxes containing predominantly iso-alkanes and normal alkanes having a carbon chain lengths greater than about 30, and synthetic waxes.

Synthetic waxes are produced by means atypical of petroleum wax production The synthetic waxes may include waxes containing branched alkanes and copolymerized with monomers such as, but not limited to, propylene and polyethylene and Fischer-Tropsch type waxes. Polyethylene wax is not in the same category as polyethylene, a polymer of ethylene monomers.

Elastomer plasticizers vary the firmness of the gum base. Their specificity on elastomer inter-molecular chain breaking (plasticizing) along with their varying softening points cause varying degrees of finished gum firmness when used in base. This is also important when one wishes to provide more elastomeric chain exposure to the alkanic chains of the waxes.

Elastomer plasticizers include natural rosin esters such as glycerol ester of partially hydrogenated rosin, glycerol ester of polymerized rosin, glycerol ester of partially dimerized rosin, glycerol ester of rosin, glycerol ester of tall oil rosin, pentaerythritol esters of partially hydrogenated rosin, partially hydrogenated methyl esters of rosin, pentaerythritol ester of rosin, synthetic elastomer plasticizers such as terpene resins derived from alpha- pinene, beta-pinene and/or d-limonene, and mixtures thereof.

The elastomer plasticizers used may be of one type or of combinations of more than one. Typically, the ratios of one to the other are dependent on each respective softening point, on each effect on flavor release, and on each respective degree of tack they cause to the gum. Ball and ring softening points of the rosin ester types described above may range from about 60 to about 120ºC. Softening points of the terpene resins may range from about 60 to about 130ºC and an average molecular weight of from about 500 to 2,000.

Occasionally, both terpene and rosin ester resins may be used in the present invention. The terpene: rosin ester ratios may range from about 1:15 to about 15:1.

Softeners modify the texture, cause the hydrophobic and hydrophilic components of the base to be miscible, and may further plasticize the synthetic elastomers of the gum base. Softeners include fully hydrogenated oils of cottonseed, soybean, palm, palm kernel, coconut, safflower and the like, as well as monoglycerides, diglycerides, acetylated monoglycerides, distilled mono- and diglycerides and de-oiled or "powdered" lecithin. The glycerides and lecithin are sometimes referred to as emulsifiers.

Fillers used in gum base modify the texture of the gum base and aid in processing. Fillers include carbonate or precipitated carbonated types such as magnesium and calcium carbonate, ground limestone and silicate types such as magnesium and aluminum silicate, clay, alumina, talc, as well as titanium oxide, mono- di- and tricalcium phosphate, cellulose polymers such as ethyl, methyl and wood or mixtures thereof.

Other optional ingredients such as antioxidants and colorants may also be used in the gum base.

Antioxidants prolong shelf-life and storage of gum base, finished gum or their respective components including fats and flavor oils. Antioxidants suitable for use in gum base or gum of the present invention include butylated hydroxyanisole (BHA), butylated hydroxytoluene (BHT), beta -carotenes, tocopherols, acidulants such as Vitamin C, propyl gallate, other synthetic and nature types or mixtures thereof in free-flowing ground or pulverized form.

Flavorants and colorants impart characteristics or remove or mask undesired characteristics. Colorants and flavorants include FD&C type lakes, plant extracts, fruit and vegetable extracts, titanium dioxide, cocoa powder or mixtures thereof in free-flowing ground or pulverized form.

THE PREFERRED PARTICULATED GUM BASE

The preferred ingredients and the preferred ranges in the particulate blend gum base of the present invention are as follows.

Elastomers in the amount of about 0 to about 30% by weight of the final particulate blend gum base are acceptable. The preferred elastomers for use in the present invention include styrene-butadiene elastomer, isoprene-isobutylene copolymer, hard polyisobutylene (Mw > 75,000), and soft polyisobutylene.

When present, vinyl polymeric elastomers comprise about 0 to about 65% by weight of the final particulate blend gum base. The preferred vinyl polymers for use in the present invention include polyvinyl acetate having a GPC average molecular weight from about 8,000 to about 65,000. More preferred are those having an average molecular weight of from about 10,000 to about 59,000.

Elastomer plasticizers in the amount of about 0 to about 45% by weight of the final particulate blend gum base are acceptable. The preferred elastomer plasticizers used in the present invention are natural rosin esters such as glycerol ester of partially hydrogenated rosin, glycerol ester of rosin, glycerol ester of tall oil rosin, partially hydrogenated methyl esters of rosin, synthetic elastomer plasticizers such as terpene resins, and mixtures thereof.

More preferably, the elastomer plasticizers used are glycerol ester of partially hydrogenated rosin, glycerol ester of rosin, glycerol ester of tall oil rosin, synthetic elastomer plasticizers such as terpene resins derived from alpha-pinene, beta-pinene and/or d-limonene, and mixtures thereof.

Softeners include emulsifiers, acetylated monoglycerides, medium chain triglycerides, glycerol triacetate, waxes and fats.

Emulsifier softeners present in the amount of about 0 to about 30% by weight of the final particulate blend gum base are acceptable. The preferred

emulsifiers include vegetable oil lecithin, de-oiled lecithin, glycerol monostearate, acetylated lecithin, and the like, and mixtures thereof.

Acetylated monoglycerides, glycerol triacetate, medium chained triglyceride softeners present in the amount of 0 to about 6% by weight of the final particulate blend gum base are effective plasticizers of the polyvinyl acetate polymer. Also, glycerol monostearate present in the amount of 0 to about 10% by weight of the final particulate blend gum base is acceptable.

Waxes in the amount of about 0 to about 40% by weight of the final particulate blend gum base are acceptable. The preferred waxes include petroleum waxes, synthetic waxes, microcrystalline waxes, paraffin waxes, natural waxes such as carnuba, beeswax and the like, and mixtures thereof.

Fats in the amount of about 0 to about 45% by weight of the final particulate blend gum base are acceptable. The preferred fats include fully hydrogenated and partially hydrogenated fats and mixtures thereof.

Fillers in the amount of 0 to about 70% by weight of the final particulate blend gum base are acceptable. The preferred fillers include calcium carbonate, ground limestone, talc, mono-, di- and tricalcium phosphate, zirconium silicate, or mixtures thereof. More preferably, the fillers used have a mean particle size range from about 0.4 to about 14 microns and are calcium carbonate and talc.

While the particle size of the hard elastomer and filler are most important, other gum base ingredients that will eventually melt when made into chewing gum, such as fats and wax, need to be sized so that they form a homogeneous mix that does not allow ingredients to settle out during transportation. The maximum particle sizes in the gum base should typically be less than 1 millimeter, more preferably less than .6 millimeters, and most preferably less than about 425 microns. Preferably, all of the particulated gum base ingredients will have a small particle size. The gum base will be more easily manufactured into chewing gum the smaller the size of the particulated ingredients. Therefore, it would be preferable to make the ingredients into as small of a size as possible. Particle size as used herein and in the claims is determined by a sieve analysis. For example, particles of

0.600 millimeters or less will pass through a sieve having openings 0.601 millimeters square.

METHODS OF MAKING A PARTICULATE BLEND GUM BASE

One aspect of the present invention includes aspects drawn to a method of making a particulate blend gum base from a plurality of gum base ingredients in particulate form. The gum base ingredients are blended to form a particulate blend gum base.

Optionally, an anti-caking agent can be added to the particulate blend gum base to prevent agglomeration. Anti-caking agents can comprise fillers, bulk sweeteners, high-intensity sweeteners, glycerol monostearate, elastomer plasticizers, fused silica and mixtures thereof.

Optionally, the gum bases of the present invention can be tabletized in a tableting press to form a tableted gum base.

A flow chart illustrating the basic processing steps of the pilot plant of the present invention is shown in FIG. 1. A schematic illustration of the pilot plant apparatus and system of the present invention is shown in FIG. 2 and referred to by the reference numeral 10. A preferred mixing and extruding apparatus is illustrated in FIG. 3. A preferred cooling mechanism is depicted in FIG. 4. Preferred cutting and grinding mechanisms are depicted in FIGS. 5 and 6, respectively. A preferred spray congealing mechanism is shown in FIG. 7. A preferred powder blender is illustrated in FIG. 8. Although not depicted in the Figures, the process of the present invention further includes a dust collection system.

Grinding

One aspect of the present invention is drawn to a method of making a particulate blend gum base comprising a gum base ingredient, or a combination of gum base ingredients, that have been particulated by grinding.

Particle size reduction, herein referred to as "grinding" or "pulverizing," is used to prepare ingredients for use in the present invention. This grinding or pulverizing is accomplished by those knowledgeable in the art of doing this and the act or process of pulverizing or grinding these ingredients is described

herein as examples of a typical process and is in no way meant to limit the scope of the claims of this invention.

Typical pulverizing or grinding begins by first course grinding bulk gum base ingredients followed by fine grinding. Shredders, pulverizers, grinders, etc. are typically used to do this. Preferably, the pulverizing process is done under cool environments, not excluding cryogenic pulverizing. These terms are familiar to those knowledgeable in this art. It is preferred to pulverize the gum base ingredients to a size of 1 millimeter or less, more preferably to a size of 0.6 millimeters or less, and most preferably to a size of about 425 microns or less.

High viscosity gum base ingredients can be individually particulated by grinding. As used herein the term "high viscosity gum base ingredient" refers to a gum base ingredient that cannot be spray congealed as described using the pilot plant equipment described herein. These ground gum base ingredients can then be blended with other gum base ingredients to form the particulate blend gum base of the invention.

"Mixtruding"

It is, however, costly to grind some ingredients, and very costly to grind hard elastomers to very small size particles. Further, certain gum base ingredients do not retain a particulated, free-flowing form if they are stored at room temperature for prolonged periods of time. Such gum base ingredients may be identified, without limiting the scope of the present invention, as having a softening point of less than about 130º F.

One aspect of the present invention overcomes such problems by combining at least one first gum base ingredients having a softening point of less than about 130ºF and a second gum base ingredient to form a combined ingredient to form a combined ingredient having a high viscosity. Preferably, the combined ingredient has a softening point intermediate of the softening points of the first and second gum base ingredients.

In a preferred method of the present invention, the first ingredient is selected from the group consisting of elastomer plasticizers, softeners,

emulsifiers, fats, waxes, liquid gum base ingredients, flavor oils, and combinations thereof and the second gum base ingredient is selected from the group consisting of hard elastomers, soft elastomers, vinyl polymer elastomers, fillers and combinations thereof.

In general; the first ingredient and the second ingredient are added to a mixer, melted and blended to form a molten mixture. Preferably, the molten mixture is homogeneously mixed. The mixer of the present invention can be either a low-efficiency batch mixer, an atomizer or a continuous mixer. The molten mixture is then extruded through an extruder of the type AMK/Ross SS Kneader Extruder 15 Gallon sigma blade type VIV GOL. Most preferably, the mixing apparatus and the extruding apparatus are combined to form a "mixtruder," having the mixtruder configuration of FIG. 3. Thereafter, the extrudate is cooled by any of various of methods know to those knowledgeable in the art. Preferably, the extrudate is conveyed along a steelbelt chiller (40) of the type SANDVIK 20 inch wide SS cooling belt to form a solid mixture. The steelbelt chiller (40) is cooled by, for example, water having a temperature of between about 40º F. to about 70º F. At this point, the solid mixture is hard, brittle and easily ground into a particulated, free-flowing form. Preferably, the solid mixture is first size reduced in a granulator and subsequently pulverized in a hammermill of the type Mikro Pulverizer 3TH SS 30 horsepower to form a solid mixture in a particulated state. This combined ingredient can be blended, at a temperature between about 40º F. to about 90ºF., more preferably between about 50º F. and about 75º F., with other gum base ingredients to form the particulate blend gum base of the invention.

Most preferably, the first ingredient is an elastomer plasticizer and the second ingredient is a hard elastomer. Alternatively, the first ingredient is an elastomer plasticizer and the second ingredient is a soft elastomer. In some instances, the second ingredient is used to encapsulate the first ingredient.

This process of mixtruding elastomer plasticizers and elastomers to form an elastomer/elastomer plasticizer preblend facilitates the grinding of elastomers and elastomer plasticizers that have not been practical to grind,

until presently. Unlike the manufacture of conventional gum base, the elastomer plasticizers/elastomer preblend is not compounded. Instead, the elastomer plasticizer sufficiently softens the elastomer to obtain a homogenous mixture by melting the elastomers and elastomer plasticizers at a temperature of about 150º F. to about 250º F. and blending the molten preblend in a mixer having a mixer speed of about 252 rpm. This contrasts with the extended running time of typical gum base processing that is necessary to break down, or compound, the molecular weights of the elastomer as in the manufacture of conventional gum base. Any remaining amount of elastomer plasticizer can be preground and added separately. Alternatively, all of the elastomer plasticizer can be added to the elastomer/elastomer plasticizer preblend.

Spray Congealing

One aspect of the present invention is drawn to a method of making a particulate blend gum base comprising a gum base ingredient, or a combination of gum base ingredients, that have been particulated by spray congealing. Spray congealing refers to the process of solidifying atomized molten droplets of gum base ingredients. This is typically done by spraying the droplets through a high-pressure spray nozzle into a cooler environment. A preferred spray congealing apparatus is illustrated in FIG. 7 and referred to as (70). The preferred spray congealing apparatus includes a heated mixer (71), a feed line (72), a spray nozzle (73), a cooler environment (74) and a collector (75). Adjusting the pressure and the temperature of the molten gum base controls the particle size of the spray.

Gum base ingredients suitable for spray congealing include low viscosity gum base ingredients, gum base ingredients having a softening point of less than about 130º F, gum base ingredients that are liquid at about 75º F. or lower, and gum base ingredients having capillary and congealing melting points less than 50º C. (or 122º F.). More preferably, gum base ingredients suitable to be particulated by spray congealing include fats, waxes, elastomer plasticizers, softeners, emulsifiers, liquid gum base ingredients, flavor oils,

antioxidants, powdered flavoring agents, active agents, high intensity sweeteners, and combinations thereof. Liquid gum base ingredients include vegetable oil lecithin, glycerol triacetate, actelated monoglycerides, medium chain triglycerides and vegatable oils.

Low viscosity gum base ingredients can be particulated by spray congealing.

Alternatively, a low viscosity gum base ingredient can be blended with a high viscosity gum base ingredient and then can be particulated in a combined form by spray congealing to form a solid mixture in a particulated state.

Alternatively, a gum base ingredient can be melted and spray congealed to form a solid particulated gum base ingredient. Preferably, the gum base ingredient that is melted is selected from the group consisting of elastomer plasticizers, microcrystalline and paraffin waxes, fully hydrogenated fats and emulsifiers. A second ingredient can be mixed into the melted gum base ingredient before spray congealing the melted gum base ingredient. The second ingredient can be a gum base ingredient or a chewing gum ingredient. Alternatively, the second ingredient can be an active agent.

Further, powdered ingredients having a particle size less than about 0.6 millimeters, such as powdered flavoring agents, high intensity sweeteners, bulk sweeteners, de-oiled lecithins, active agents, such as pharmaceuticals, nutraceuticals, probiotics, phytochemicals and the like, can be blended with the blend of molten ingredients to form a combined ingredient having a viscosity greater than about 80,000 centipoises at 250º F., and then atomized to form a particulated, free-flowing blend.

In one embodiment, at least one first gum base ingredient having a softening point of less than about 130º F. is combined with a second gum base ingredient and spray congealed to form a particulated combined ingredient. Preferably, the first ingredient having a softening point of less than about 130º F. is selected from the group consisting of fats waxes, emulsifiers, softeners, liquid gum base ingredients, flavor oils, and combinations thereof and the second ingredient is selected from the group consisting of

antioxidants, powdered flavoring agents, active agents and combinations thereof.

Alternatively, at least one first gum base ingredient having a softening point greater than 130º F. is combined with a second gum base ingredient and spray congealed to form a particulated combined ingredient. Preferably, the first ingredient having a softening point greater than 130º F. is selected from the group consisting elastomer plasticizers, hydrogenated fats, waxes and emulsifiers, each having a softening point of greater than 130º F. Preferably, the second gum base ingredient has a softening point of less than 130º F. Alternatively, the second ingredient is a liquid at 75º F. Alternatively, the second ingredient is a solid particle with a particle size of 0.6 millimeters or less. Preferably, the second gum ingredient is selected from the group consisting of active agents, powdered flavoring agents, high intensity sweeteners and de-oiled lecithins.

Alternatively, a first gum base ingredient having a viscosity greater than about 80,000 centipoises at 250º F. and a second gum base ingredient are blended together in a liquid form to form combined ingredient having a viscosity of less than about 80,000 centipoises at about 250º F. The combined ingredient is spray congealed to form a particulated combined ingredient. Preferably, the first gum base ingredient is a polyvinyl acetate having a molecular weight greater than 5,000. Preferably, the second gum base ingredient has a softening point of less than 130º F. Alternatively, the second ingredient is a liquid at 75º F. Alternatively, the second ingredient is a solid particle with a particle size of 0.6 millimeters or less. Preferably, the second gum ingredient is selected from the group consisting of active agents, powdered flavoring agents, high intensity sweeteners and de-oiled lecithins.

In the preferred embodiment, the spray nozzle comprises a NORDSON H20T single module heat melt gun having a No. 25 nozzle restricting plate. The air pressure supplied to the spray nozzle is about 80 psi. It is important to note that the type of spray nozzle used and the pressure supplied to the spray nozzle determines the viscosity at which an ingredient, or a combination of ingredients, can be spray congealed. An ingredient (or a combination of

ingredients) having a viscosity less than about 80,000 centipoises at 250º F. can be spray congealed using the preferred spray congealing apparatus of the present invention. As used herein, the term "low viscosity gum base ingredient" refers to a gum base ingredient having a viscosity less than about 80,000 centipoises at about 250º F. Although these viscosities are preferred, other spray congealing equipment may be used to spray congeal more viscous material. Preferably, the first and second ingredients are melted to form a homogenous mixture. This mixture is then blended with or is melted in the presence of at least one ingredient such that the combined ingredient can be particulated by spray congealing. Most preferably, the first and second ingredients are melted in a mixer (71) to form a homogenous mixture. The homogenous mixture is fed through a feed-line (72) to a high-pressure spray nozzle (73). Spraying, or atomizing, the molten gum base mixture into a cooler environment (74), having a temperature of about minus 19º F. to about 75º F., causes the droplets of molten gum base mixture (not shown) to solidify to form a combined ingredient having a particulated, free-flowing form, which is collected by collector (75).

Optionally, an anti-caking agent can be added to the particulated solid mixture. Preferably, the anti-caking agent is selected from the group consisting of fillers, bulk sweeteners, glycerol monostearate and elastomer plasticizers, fused silica and mixtures thereof. Preferably, the anti-caking agent is added at a level of between about 0.5% and about 80% of the total weight of the ingredient.

The particulated gum base ingredient can then be blended with other gum base ingredients to form the particulate blend gum base of the invention.

Particle Blending

After the gum base ingredients have been put in powder form by grinding, mixtruding and grinding, and/or spray congealing, a plurality of particulated gum base ingredients can be blended to form the particulate blend gum base of the present invention.

In general, a plurality of particulated gum base ingredients is supplied to a powder blender. Preferably, the blender has a temperature of about 50º F. to about 75º F. and a blender speed of about 10 rpm to about 30 rpm. Most preferably, the blender is a v-blender (80) familiar to those in the art of blending particulated ingredients, having the v-blender configuration illustrated in FIGS. 2 and 8. The particulated gum base ingredients are blended for a blending time of about 3 to about 60 minutes, more preferably about 5 to about 15 minutes, and most preferably about 10 minutes or less, to form the particulate blend gum base of the present invention.

Optionally, an anti-caking agent can be added to the plurality of particulated gum base ingredients

Gum Manufacture

Although the present invention is described herein with reference to its use in the manufacture of a gum base, those knowledgeable in this art will recognize that the present invention also relates to the manufacture of a chewing gum composition.

In general, a plurality of particulated gum base ingredients is added to a sigma-blade, steam jacketed gum mixer as a particulate blend. The gum mixer can be a low efficiency mixer or a continuous mixer. The initial kettle temperature of the gum mixer is preferably between about 68º F. to about 104º F. Additional gum ingredients are added to the mixer and the combination of the particulated gum base ingredients and additional gum ingredients in the gum mixer are mixed to form a gum composition.

The combination of the particulated gum base ingredients and the gum ingredients can be added at the same time to the mixer. The gum composition can be manufactured continuously or in batches.

Preferably, the blend of the particulated gum base ingredients is prepared at the same facility as where the blend is used.

Preferably, the particulated gum base ingredients and additional gum ingredients are mixed for a mixing time of about 10 minutes or less to form the gum composition of the present invention.

Certain aspects of the invention are described in detail by the non-limiting Examples set forth below. These Examples are presented to exemplify certain embodiments of the present invention and in no way are presented to limit the scope of the present invention. Comparative Examples describing the manufacture of conventional gum base formulations are also set forth below. Unless stated otherwise, all percentages are based on weight.

EXAMPLE 1

Example 1 was carried out according to the most preferred embodiment of the present invention. A particulate blend gum base with the following formula was prepared:

INGREDIENT	WEIGHT PERCENT
Hard Elastomer –	
Butyl elastomer Mw > 75,000	11.85
Soft Elastomer –	
Polyisobutylene Mw < 75,000	3.95
Elastomer Plasticizer –	
Terpene Resin	19.75
Vinyl Polymer Elastomer –	
Polyvinyl Acetate Mw about 14,000	27.59
Filler –	
Calcium Carbonate	11.85
Emulsifier –	
Vegetable Oil Lecithin	3.95
Fully Hydrogenated Fats –	
Hydrogenated Cottonseed Oil	5.78
Hydrogenated Soybean Oil	5.77
Partially Hydrogenated Fats –	5.25
Softener –	
Glycerol Monostearate	4.20
Antioxidant –	
BHT	0.06
Total	100.00%

The particulate blend gum base of Example 1 was made by blending in a v-blender, as depicted in FIG. 8 and described above, about 79%

particulated elastomer and resin blend and about 21% a particulated wax/fat blend.

The elastomer and resin blend was prepared as follows. Using a mixtruder having the configuration of FIG. 3, a mixer speed of about 252 rpm, and a temperature of between about 150º F. and 250º F., about 15% butyl elastomer, 15% calcium carbonate, 5% low molecular weight polyisobutylene (Mw < 75,000) was added to the mixer and mixed for about 15 minutes. Thereafter, the following ingredients were sequentially added and mixed in 5 minute intervals: about 6% terpene resin, about 19% terpene resin, about 35% low molecular weight polyvinyl acetate (Mw about 14,000) and about 5% vegetable oil lecithin. The composition had a temperature of between about 150 º F. and 250º F. for a total mixing time of about 35 minutes. Thereafter, the elastomer and resin blend was removed from the mixer and extruded through an extruding screw having a temperature like that of the mixer temperature. The extrudate was fed at about 250 to about 300 lbs/hr onto a cooling belt and chilled to a temperature of about minus 19º F. and 75º F. thereby making the elastomer/elastomer plasticizers pre-blend hard and brittle. Next, the elastomer and resin blend was fed into a granulator and fragmented to the size of less than or equal to about 0.25 inches. Thereafter, the fragmented elastomer/elastomer plasticizers pre-blend was fed to a hammermill and ground to a particle size less than 0.6 millimeters.

The particulated wax/fat blend was prepared by melting and blending: 25% hydrogenated cottonseed oil, 30% hydrogenated soybean oil, 25% partially hydrogenated fat, 19.7% glycerol monostearate, and 0.3% antioxidant. The molten wax/fat blend was spray congealed using an atomizer of the type Nordson 3800 Hot Melt Adhesive Sprayer and a configuration of FIG 7. The molten wax/fat blend was fed through a high-pressure spray nozzle using air supplied at a pressure of 80 psi, as the mixing kettle was at a temperature of about 100º F. to 350º F. and the spray hose and spray head at the same temperature range. The atomized wax/fat blend was sprayed into a cooler environment having a temperature of between about minus 19º F. and 75º F. and a configuration of FIG. 7. Once the

atomized wax/fat blend droplets left the nozzle and contacted the cooler environment, the droplets congealed and solidified as to form solid particles having an average particle size of about 0.6 millimeters.

COMPARATIVE EXAMPLE A

Comparative Example A was carried out according to the conventional method of manufacture. A conventional gum base with the following formula was prepared as follows:

Using a sigma blade mixer, and in the presence of heat and shear, about 11.85% butyl elastomer, about 11.85% calcium carbonate, and about 3.95% low molecular polyisobutylene (Mw < 75,000) were added and compounded for about 30 minutes at a temperature of between about 95º C. (203º F). and 120º C. (or 248º F). Thereafter, about 19.75% terpene resin was added in quarter increments every 10 minutes. After an hour of mixing, about 6.90% low molecular weight polyvinyl acetate (Mw about 14,000) was added. After an additional 10 minutes of mixing, the remainder of the low molecular weight polyvinyl acetate (Mw about 14,000), about 20.69%, was added and mixed for another 10 minutes. Next, about 4.20% glycerol monostearate and about 5.77% hydrogenated soybean oil were added and mixed for 5 minutes. Then, about 0.06% antioxidant, about 5.78% hydrogenated cottonseed oil and about 5.25% partially hydrogenated fat was added and mixed for another 5 minutes. Finally, about 3.95% vegetable oil lecithin was added and the composition was blended for about 10 minutes. After a total mixing time of about 1 hour 50 minutes, the conventional gum base was removed from the mixer, passed through a basket filter using an 80-mesh sock.

As can be seen by the Example 1 and Comparative Example A, the particulate blend gum base of Example 1 was formed after a mixing time of about 35 minutes whereas; Comparative Example A required a mixing time of about 1 hour and 50 minutes.

EXAMPLE 2

Example 2 was carried out according to the most preferred embodiment of the present invention. A particulate blend gum base with the following formula was prepared:

INGREDIENT	WEIGHT PERCENT
Hard Elastomer –	
Butyl elastomer Mw > 75,000	3.95
Styrene- Butadiene elastomer	2.37
Soft Elastomer –	
Polyisobutylene Mw < 75,000	7.90
Elastomer Plasticizer –	
Natural Gum Rosin	15.80
Vinyl Polymer Elastomers –	
Polyvinyl Acetate Mw about 14,000	7.90
Polyvinyl Acetate Mw about 55,000	23.70
Filler –	
Talc	15.77
Emulsifier –	
Vegetable Oil Lecithin	1.58
Fully Hydrogenated Fats –	
Hydrogenated Cottonseed Oil	4.72
Hydrogenated Soybean Oil	4.73
Partially Hydrogenated Fats –	4.20
Softeners –	
Glycerol Monostearate	6.30
Acetylated Monoglycerides	1.05
Antioxidant –	
BHT	0.03
Total	100.00%

The particulate blend gum base of Example 2 was made by blending in a v-blender, as depicted in FIG. 8 and described above, about 80% particulated elastomer and resin blend and about 20% particulated wax/fat blend.

The elastomer and resin blend was prepared as follows. Using a mixtruder having the configuration of FIG. 3, a sigma blade mixer speed of about 252 rpm, and a temperature of between about 150º F. and 250º F., about 5% low molecular weight polyisobutylene (Mw < 75,000), about 5% butyl elastomer, about 3% styrene butadiene, about 19.86% talc and about

14% high molecular weight polyvinyl acetate (Mw about 55,000) was added and mixed for about 20 minutes. Next, about 16% high molecular weight polyvinyl acetate (Mw about 55,000), about 5% low molecular weight polyisobutylene (Mw < 75,000), and about 8% natural gum rosin was added and mixed for about 5 minutes. Then, about 12% natural gum rosin and about 10% low molecular weight polyvinyl acetate (Mw about 14,000) was added and mixed for about 5 minutes. Finally, about 2% vegetable oil lecithin was added. After a total mixing time of about 35 minutes, the elastomer and resin blend was removed ground to a particle size of about 0.60 millimeters or less using the method set forth in Example 1.

The particulated wax/fat blend was prepared by melting and blending: 22% hydrogenated cottonseed oil, 23% hydrogenated soybean oil, 20% partially hydrogenated fat, 30% glycerol monostearate, 5% acetylated monoglyceride and 0.14% antioxidant to form a wax/fat blend. The molten wax/fat blend was spray congealed using method set forth in Example 1 to form solid particles having an average particle size of about 0.6 millimeters.

COMPARATIVE EXAMPLE B

Comparative Example 2 was carried out according to the conventional method of manufacture. A conventional gum base with the formula Example 2 was prepared as follows:

Using a sigma blade mixer, and in the presence of heat and shear, about 10.43% high molecular weight polyvinyl acetate (Mw about 55,000), about 2.37% styrene-butadiene elastomer, about 3.95% butyl elastomer, about 3.95% low molecular weight polyisobutylene (Mw < 75,000) and about 15.77% talc were added and mixed for about 30 minutes. Then, about 5.21% natural gum rosin, about 13.27% high molecular weight polyvinyl acetate (Mw about 55,000) and about 3.95% low molecular weight polyisobutylene (Mw < 75,000) was added and mixed for about 10 minutes. Next, about 70.9% low molecular weight polyvinyl acetate (Mw about 14000) was added and mixed for about 10 minutes. Next, about 10.59% natural gum rosin was added and mixed for about 15 minutes. Then, about 4.73% hydrogenated soybean oil

and about 4.72% hydrogenated cottonseed oil were added and mixed for 15 minutes. Thereafter, about 6.30% glycerol monostearate, about 0.03% antioxidant, about 1.05% acetylated monoglcyerides and about 4.20% partially hydrogenated fat were added and mixed for another 15 minutes. Finally, 1.58% vegetable oil lecithin was added and the composition was blended for about 10 minutes.

After a total mixing time of about 1 hour 45 minutes, the conventional gum base was removed from the mixer, passed through a basket filter using an 80-mesh sock.

As can be seen by comparing Example 2 with Comparative Example B, the particulate blend gum base of Example 2 was formed after a mixing time of about 35 minutes whereas; Comparative Example B required a mixing time of about 1 hour and 45 minutes.

EXAMPLE 3

Example 3 was carried out according to the most preferred embodiment of the present invention. A particulate blend gum base with the following formula was prepared:

INGREDIENT	WEIGHT PERCENT
Soft Elastomer –	
Polyisobutylene Mw < 75,000	12.9
Elastomer Plasticizer –	
Natural Gum Rosin	21.5
Vinyl Polymer Elastomer –	
Polyvinyl Acetate Mw about 55,000	26.7
Filler –	
Talc	16.3
Fully Hydrogenated Fats –	
Hydrogenated Cottonseed Oil	2.8
Softeners –	
Glycerol Monostearate	4.9
Glycerol Triacetate	8.6
Wax –	
Microcrystalline wax	2.1
Paraffin wax	4.2
Total	100.0%

The particulate blend gum base of Example 3 was made by powder blending in a v-blender as depicted in FIG. 8, about 86% particulated elastomer and resin blend and about 14% particulated wax/fat blend.

The elastomer and resin blend was prepared as follows. The elastomer and resin blend was prepared as follows. Using a mixtruder having the configuration of FIG. 3, a mixer speed of about 252 rpm, and a temperature of between about 150º F. and 250º F., about 31% high molecular weight polyvinyl acetate (Mw about 55,000) and about 10% glycerol triacetate were added and mixed for about 10 minutes. Next, about 25% natural gum resin and about 8% talc were added and mixed for about 10 minutes. Finally, about 15% low molecular weight polyisobutylene Mw < 75,000 and about 17% natural gum resin were added. Thereafter, the composition was mixed. After a total mixing time of about 25 minutes, the elastomer and resin blend was removed and ground to a particle size of about 0.6 millimeters using the method set forth in Example 1.

The particulated wax/fat blend was prepared by melting and blending: about 15% microcrystalline wax, 20% by weight of hydrogenated cottonseed oil, 33.33% glycerol monostearate, 35% paraffin wax to form a wax/fat blend. The molten wax/fat blend was spray congealed using method set forth in Example 1 to form solid particles having an average particle size of about 0.6 millimeters.

COMPARATIVE EXAMPLE C

Comparative Example 3 was carried out according to the conventional method of manufacture. A conventional gum base having a formula of Example 3 was prepared as follows:

Using a sigma blade mixer, and in the presence of heat and shear, about 26.7% high molecular weight polyvinyl acetate Mw about 55,000 and about 8.6% glycerol triacetate were added and mixed for about 15 minutes. Next, about 7.2% natural gum rosin and about 5.7% talc were added and mixed for about 10 minutes. Then, about 8.0% natural gum rosin and about 3.6% talc were added and mixed for about 10 minutes. Additional about 6.3% natural gum rosin and about 3.5% talc were added and mixed for about 5

minutes. Thereafter, about 12.9% low molecular weight polyisobutylene (Mw < 75,000), and the remaining talc, about 3.5.%, were added and mixed for about 20 minutes. Then, about 4.2% paraffin wax was added and mixed for about 5 minutes. Next, about 2.1% microcrystalline wax was added and mixed for another 5 minutes. Next, 2.8% hydrogenated cottonseed oil and about 2.4% glycerol monostearate were added and mixed for about 15 minutes. Finally, about 2.5% vegetable oil lecithin was added.

After a total mixing time of about 1 hour 30 minutes, the conventional gum base was removed from the mixer and passed through a basket filter using an 80-mesh sock.

As can be seen by comparing Example 3 with Comparative Example C, the particulate blend gum base of Example 3 was formed after a mixing time of about 25 minutes whereas; Comparative Example C required a mixing time of about 1 hour and 30 minutes.

EXAMPLE 4

Example 4 was carried out according to the most preferred embodiment of the present invention. A particulate blend gum base with the following formula was prepared:

INGREDIENT	WEIGHT PERCENT
Hard Elastomer –	
Isoprene-Isobutylene Elastomer	6.20
Styrene-Butadiene Elastomer	2.20
Polsyisobutylene Mw > 75,000	14.40
Elastomer Plasticizer –	
Natural Gum Rosin	16.60
Vinyl Polymer Elastomer –	
Polyvinyl Acetate Mw about 14,000	10.80
Polyvinyl Acetate Mw about 55,000	5.00
Filler –	
Calcium Carbonate	19.36
Fully Hydrogenated Fats –	
Hydrogenated Cottonseed Oil	6.40
Hydrogenated Soybean Oil	4.80
Partially Hydrogenated Fats -	2.80
Softeners –	
Glycerol Monostearate	4.20

Glycerol Triacetate	0.70
Wax –	
Microcrystalline wax	7.00
Paraffin wax	2.80
Antioxidant –	
BHT	0.04
Total	100.00%

The particulate blend gum base of Example 4 was made by powder blending in a v-blender as depicted in FIG. 8, about 72% particulated elastomer and resin blend and about 28% particulated wax/fat blend.

The elastomer and resin blend was prepared as follows. The elastomer and resin blend was prepared as follows. Using a mixtruder having the configuration of FIG. 3, a mixer speed of about 252 rpm, and a temperature of between about 150º F. and 250º F., about 3% styrene-butadiene elastomer, about 6% isoprene-isobutylene elastomer, about 20% high molecular weight polyisobutylene (Mw > 75,000), about 2% natural gum rosin, about 7% high molecular weight polyvinyl acetate (Mw about 55,000) and about 27% calcium carbonate were added and mixed for about 30 minutes. Next, about 12% natural gum resin, about 15% low molecular weight polyvinyl acetate (Mw about 14,000), about 1% glycerol triacetate, and the remaining natural gum rosin, about 7%, were added, for about 10 minutes. After a total mixing time of about 45 minutes, the elastomer and resin blend was removed and ground to a particle size of about 0.6 millimeters using the method set forth in Example 1.

The particulated wax/fat blend was prepared by melting and blending about 24.83% microcrystalline wax, about 10% paraffin wax, about.10% partially hydrogenated fat for about 5 minutes. Next, about 15% glycerol monostearate, about 17% hydrogenated soybean oil, about 20% by hydrogenated cottonseed oil and about 0.17% antioxidant were added and blended to form a wax/fat blend. The molten wax/fat blend was spray congealed using method set forth in Example 1 to form solid particles having an average particle size of about 0.6 millimeters.

COMPARATIVE EXAMPLE D

Comparative Example 4 was carried out according to the conventional method of manufacture. A conventional gum base having a formula of Example 4 was prepared as follows:

Using a sigma blade mixer, and in the presence of heat and shear, about 2.20% styrene-butadiene elastomer, about 4.34% isoprene-isobutylene elastomer, about 21.6% calcium carbonate, about 1.08% natural gum rosin and about 5% high molecular weight polyvinyl acetate (Mw about 55,000) were added and mixed for about 30 minutes. Then, about 14.40% low molecular weight polyisobutylene (Mw < 75,000) was added and blended for about 15 minutes. Next, about 3.14% natural gum rosin was added and mixed for about 5 minutes. Then, about 6.05% natural gum rosin was added and mixed for about 10 minutes.

Thereafter, about 9.80% low molecular weight polyvinyl acetate (Mw about 14,000) was added and mixed for about 10 minutes. Then, about 5.33% natural gum rosin, about 0.70% glycerol triacetate were added. After 10 minutes of mixing, about 2.80% partially hydrogenated fat was added and mixed for about 10 minutes.

Next, about 2.80% paraffin wax and about 3.38% microcrystalline wax were added. After 3 minutes of mixing, an additional about 2.62% microcrystalline wax was added and the composition was mixed for about 7 minutes.

Thereafter, about 5.33% hydrogenated cottonseed oil, about 3.80% hydrogenated soybean oil, about 2.80% glycerol monostearate, about 2.80% partially hydrogenated vegetable oil and about 0.05% antioxidant were added and the composition was mixed.

After a total mixing time of about 2 hours and 10 minutes, conventional gum base was removed from the mixer, passed through a basket filter using an 80 mesh sock.

As can be seen by comparing Example 4 with Comparative Example D, the particulate blend gum base of Example 4 was formed after a mixing

time of about 45 minutes whereas; Comparative Example D required a mixing time of about 2 hours and 10 minutes.

Further the particulate blend gum base of Example 4 includes novel ingredients not typically found in gum base such as polyvinyl acetate (Mw about 14,000) and glycerol triacetate.

EXAMPLE 5

Example 5 was carried out according to the most preferred embodiment of the present invention. A particulate blend gum base with the following formula was prepared:

INGREDIENT	WEIGHT PERCENT
Soft Elastomer –	
Polyisobutylene Mw < 75,000	10.20
Elastomer Plasticizer –	
Natural Gum Rosin	17.00
Vinyl Polymer Elastomer –	
Polyvinyl Acetate Mw about 55,000	34.00
Filler –	
Talc	19.55
Softeners –	
Glycerol Monostearate	4.25
Glycerol Triacetate	8.25
Wax –	
Paraffin wax	6.75
Total	100.00%

The particulate blend gum base of Example 5 was made by powder blending in a v-blender depicted in FIG. 8, about 85% particulated elastomer and resin blend and about 15% particulated wax/fat blend.

The elastomer and resin blend was prepared as follows. Using a mixtruder having the configuration of FIG. 3, a mixer speed of about 252 rpm, and a temperature of between about 150º F. and 250º F., about 40% high molecular weight polyvinyl acetate (Mw about 55,000), about 20% natural gum rosin, about 12% low molecular weight polyisobutylene (Mw < 75,000), about 5% glycerol triacetate and about 23% talc were added for a total mixing time of about 10 minutes. The elastomer and resin blend was removed and

ground to a particle size of about 0.6 millimeters using the method set forth in Example 1.

The particulated wax/fat blend was prepared by melting and blending about 45% paraffin wax, about 54.68% glycerol monostearate, and about 0.32% antioxidant to form a wax/fat blend. The molten wax/fat blend was spray congealed using method set forth in Example 1 to form solid particles having an average particle size of about 0.6 millimeters.

COMPARATIVE EXAMPLE E

Comparative Example 5 was carried out according to the conventional method of manufacture. A conventional gum base having a formula of Example 5 was prepared as follows:

Using a sigma blade mixer, and in the presence of heat and shear, about 34% high molecular weight polyvinyl acetate (Mw about 55,000), about 5.10% low molecular weight polyisobutylene (Mw < 75,000) and about 7.03% talc were added and mixed for about 5 minutes. Next, 5.10% low molecular weight polyisobutylene (Mw < 75,000), about 4.25% glycerol triacetate and about 7.03% talc were added and mixed for about 20 minutes. Then about 17.00% natural gum rosin and about 5.49% talc were added and mixed for about 50 minutes. Then, about 6.75% paraffin wax was added and mixed for about 20 minutes. Finally, about 8.20% glycerol monostearate and about 0.05% antioxidant were added and the composition was blended for about 20 minutes. After a total mixing time of about 1 hour 45 minutes, conventional gum base was removed from the mixer, passed through a basket filter using an 80-mesh sock.

As can be seen by comparing Example 5 with Comparative Example E, the particulate blend gum base of Example 5 was formed after a mixing time of about 10 minutes whereas, Comparative Example E required a mixing time of about 1 hour and 45 minutes.

Further the particulate blend gum base of Example 5 does not include a hard elastomer but does include novel ingredients not typically found in gum base such as glycerol triacetate.

METHODS OF PREVENTING AGGLOMERATION

One aspect of the present invention is drawn to a method for preventing agglomeration of one or more powder gum base ingredients by blending a plurality of particulate blend gum base ingredients with an anti-caking agent.

In general, a plurality of particulated gum base ingredients are added to the v-blender (80) and blended for about 3 to about 60 minutes, preferably for about 5 to about 15 minutes, and most preferably for about 10 minutes or less to form a particulate blend of gum base ingredients. An anti-caking agent is added to the particulate blend of gum base ingredients at a level sufficient to prevent the particulate blend gum base from agglomerating when left unagitated at a temperature of at least about 58º F. for a period of at least about 48 hours. Preferably, the particulate blend of gum base ingredients is maintained in a low moisture environment. As used herein, the term "low moisture environment" refers to an environment having a low relative humidity and, more specifically refers to an environment having a relative humidity of 35% or less.

Preferably, the anti-caking agent is selected from the group consisting of fillers, bulk sweeteners, glycerol monostearate, elastomer plasticizers, fused silica and mixtures thereof.

When the anti-caking agent is glycerol monostearate, it is present in the amount of between about 5% and 20% by weight of the particulate blend gum base.

Alternatively, when the anti-caking agent is filler, it is present in the amount of between about 0 to about 70% by weight of the particulate blend gum base. More preferably, the filler is selected from the group consisting of calcium carbonate, magnesium carbonate, ground limestone, silicates, zirconium silicate, clay, alumina, talc, titanium oxide, mono- di and tridcalcium phosphate, cellulose polymers and mixtures thereof.

Elastomer plasticizers suitable for use as anti-caking agents include natural rosin esters, glycerol ester of partially hydrogenated rosin, glycerol ester of polymerized rosin, glycerol ester of partially dimerized rosin, glycerol

ester of rosin, glycerol ester of tall oil rosin, pentaerythritol esters of partially hydrogenated rosin, partially hydrogenated methyl esters of rosin, pentaerythritol ester of rosin, synthetic elastomer plasticizers, terpene resins derived from alpha-pinene, beta-pinene and d-limonene and mixtures thereof and can be added to the blend at a level of between about 0.5% to about 20%.

Sugar sweeteners suitable for use as anti-caking agents include sucrose, dextrose, maltose, dextrin, dried invert sugar, fructose, levulose, galactose, corn syrup solids and combinations thereof and can be added to the blend at a level of up to about 80%.

Sugarless sweeteners suitable for use as anti-caking agents include sorbitol, mannitol, xylitol, hydrogenated starch hydrolysates, maltitol and combinations thereof and can be added to the blend at a level of up to about 80%.

When the anti-caking agent is a fused silica it can be added to the blend at a level of between about 0.5% and about 2%.

High intensity sweeteners suitable for use as anti-caking agents include sucralose, aspartame, salts of acesulfame, alitame, saccharin and its salts, cyclamic acid and its salts, gycyrrhizin, dyhydrochalcones, thaumatin, monellin and combinations thereof.

In another aspect, the present invention includes aspects drawn to a method for preventing agglomeration of one or more powder gum base ingredients by agitating a particulate blend of gum base ingredients.

In general, a plurality of particulated gum base ingredients are added to the v-blender (80) and blended for about 3 to about 60 minutes, preferably for about 5 to about 15 minutes, and most preferably for about 10 minutes or less to form a particulate blend of gum base ingredients. The particulate blend of gum base ingredients are agitated until just prior to the addition of the particulate blend of gum base ingredients to a gum mixer.

METHOD OF MAKING GUM BASES WITH A HIGH DEGREE OF CONSISTENCY FROM ONE BATCH TO THE NEXT

In another aspect, the present invention is drawn to a method of manufacturing a gum base so as to have a high degree of consistency from one batch. The use of particulated gum base ingredients to form a particulated blend of gum base ingredients without forming a molten gum base ensures a more accurate delivery of the gum base ingredients to the blender. In addition, blending the gum base ingredients without forming a molten gum base greatly simplifies the cleaning of the process equipment. Preferably, cleaning the process equipment merely entails blowing air through, or tapping on the sides of, the process equipment.

In general, gum base ingredients in particulate form are blended without forming a molten gum base to form a first batch of powder blend gum base. The first batch of particulate blend gum base is emptied from the mixer and tested for percent ash content, antioxidant content and softening point. A second batch of particulate blend gum base is prepared by repeating the process and blending subsequent gum base ingredients in particulate form without forming a molten gum base to form a second batch of particulate blend gum base. The second batch of particulate blend gum base is emptied from the mixer and tested for percent ash content, antioxidant content and softening point. The variation in percent ash content, antioxidant content and softening point between the first and the subsequent batch is about 5% or less. More preferably, the variation is about 1% or less.

METHODS OF MAKING GUM BASES WITH MINIMAL CONTAMINATION

In another aspect, the present invention is drawn to a method of manufacturing two or more gum bases each having a different composition using the same equipment and minimizing the amount of first composition carried over into the second composition between the manufacture of the first gum base and the second gum base.

In general, a plurality of first gum base ingredients in particulate form are added to a mixer, blended to form a first particulate particulate blend of first gum base ingredients and emptied out of the mixer. Preferably, the mixer is a "V" shaped powder blender as depicted in FIG. 8.

The use of particulated gum base ingredients to form a particulate blend of gum base ingredients minimizes the amount of residual gum base left behind in the process equipment. The amount of first gum base ingredients left behind in the mixer is less than about 1% of the volume of the mixer. Subsequently, a plurality of second gum base ingredients is added to the mixer and blended to form a particulate blend of second gum base ingredients.

REMOTELY CONTROLLED METHODS OF MAKING A PARTICULATE BLEND GUM BASE

In another aspect, the present invention is drawn to a remotely controlled method for making a particulate blend gum base from a plurality of gum base ingredients in a particulate form comprising the steps of: providing a plurality of storage compartments each storing at least one of said plurality of gum base ingredients in a particulate form; providing automated controls to allow remote control dispensing of said at least one of said plurality of gum base ingredients in a particulate form from each of said storage compartments; selecting a gum base to be made; remotely activating said controls to dispense a desired amount of each of said at least one of said plurality of gum base ingredients in a particulate form from said plurality of storage compartments; and blending the desired amounts of the plurality of gum base ingredients in particulate form to form a particulate blend gum base.

Preferably, the ingredients are dispensed onto a conveyor by which they are conveyed to a powder blender.

Preferably, all of the ingredients for one batch of gum base are dispensed into one collecting container, which is then used to transport the ingredients to a powder blender.

Preferably, a computer has a plurality of gum base recipes stored therein and signals the controls to said plurality of dispense gum base ingredients in particulate form based on a selected one of said recipes stored in the computer.

Preferably, at least some of the storage compartments are equipped with agitators to maintain the at least one gum base ingredient in particulate form stored therein in a free-flowing state.

Preferably, at least one of the storage compartments houses a pulverized hard elastomer pre-blended with an elastomer plasticizer.

Optionally, the storage compartments can be storage containers.

Preferably, the final packaged particulated product is rotated or mechanically blended to provide a consistent mix of each individual particulated ingredient or blends of particulated ingredients within the package.

METHODS OF MAKING A BATCH OF GUM

One aspect of the present invention is drawn to a method of making a batch of gum. In general, one or more containers each of which contains pre-weighed amounts of a plurality of gum base ingredients in particulate form are emptied into a gum mixer. Additional gum ingredients are added to the gum mixer to prepare for making a batch of gum. The gum base ingredients and additional gum ingredients are mixed to form a batch of gum.

Preferably, the containers are bags. More preferably, the gum base ingredients in the containers are homogenously blended together before being place in the containers. Although it is not preferred, the particulate blend gum base ingredients in the containers can be at least partially agglomerated. Most preferably, the particulate gum base ingredients in the containers are in the form of a free-flowing powder. Preferably, each of the containers of particulated gum base ingredients includes an anti-caking agent.

Preferably, the gum base ingredients are mixed together in the mixer prior to the addition of any of the additional gum ingredients to the mixer. Alternatively, but less preferred, the additional gum ingredients are added to

the mixer prior to when the one or more containers of gum base ingredients are emptied into the mixer.

METHODS OF MAKING A GUM HAVING A TEMPERATURE SENSITIVE INGREDIENT

One aspect of the present invention is drawn to a method of making a gum composition comprising a temperature sensitive ingredient. The low temperature and shorter mixing times used in the method of the present invention facilitate the use of temperature sensitive ingredients in the manufacture of gum.

In general, a particulate blend gum base and other gum ingredients, including a temperature sensitive ingredient, are added to a gum mixer and mixed to form a gum composition. The temperature sensitive ingredient is mixed into the other ingredients earlier in the mixing process than when the temperature sensitive ingredient is conventionally mixed into the gum composition made using a molten gum base.

Temperature sensitive ingredient suitable for use include active agents, emulsifiers such as lecithin, antioxidants, flavor agents, high-intensity sweeteners, and combinations thereof.

Preferably, the particulated gum base ingredients are added to a gum mixer having an initial kettle temperature of between about 20º C.(or 68º F.) to about 40º C. (or 104º F.).

Preferably, the powder blend gum base and the other gum ingredients, including the temperature sensitive ingredient are mixed for a period of time to form a gum composition. More preferably, the period of time is shorter than the period of time required to mix a conventional gum composition using a melted gum base.

Alternatively, the temperature sensitive ingredient can be added to the mixer prior to the addition of the powder blend gum base.

Alternatively, the temperature sensitive ingredient can be mixed into the other ingredients with the initial addition of gum ingredients in the mixing process.

METHODS OF MAKING A GUM USING REDUCED TEMPERATURES

Another aspect of the present invention is drawn to a method of making a gum composition using reduced temperatures. In general, gum base ingredients in particulate form are added to a gum mixer having an initial kettle temperature of between about 20º C. (or 68º F.) to about 40º C. (or 104º F.) and adding additional gum ingredients to the mixer and mixing all of the ingredients to form the gum composition.

METHODS OF MAKING A GUM USING REDUCED MIXING TIME

Another aspect of the present invention is drawn to a method of making a gum composition using a particulate blend gum base and mixing the gum for less time than would be used to make the same gum composition using a gum base having the same composition as the particulate blend gum base but in a melted state.

METHODS OF MAKING A GUM AND WRAPPING GUM PRODUCTS WITHOUT CONDITIONING

Another aspect of the present invention is drawn to a method of making a gum composition and wrapping gum products made therefrom without the need to condition the gum composition prior to wrapping.

In general, a particulate blend gum base is used to make a gum composition. The gum composition is formed into stick and the gum products are wrapped without conditioning the gum.

Preferably, the gum products are wrapped within less than an hour after being formed from the composition.

Claims

1. A method of making a particulate blend gum base comprising the steps of:

a) providing at least one first gum base ingredient having a softening point of less than about 130° F.;

b) providing a second gum base ingredient;

c) combining said at least one first and second gum base ingredients to form a combined ingredient having a particulated, free-flowing form;

d) blending the combined ingredient at a temperature in the range of about 40°F to about 90°F with at least a third gum base ingredient to form the particulate blend gum base, said particulate blend base comprising at least an elastomer, a softener, an antitack ingredient, and a filler.

2. The method of claim 1 wherein the first and second ingredients are initially mixed to form a combined ingredient having a softening point intermediate of the softening points of the first and second ingredients.

3. The method of claim 1 wherein the first ingredient is an elastomer plasticizer and the second ingredient is a hard elastomer.

4. The method of claim 3 wherein the elastomer plasticizer and hard elastomer are blended and then pulverized.

5. The method of claim 1 wherein the second ingredient is used to encapsulate the first ingredient.

6. The method of claim 1 wherein the first ingredient is selected from the group consisting of elastomer plasticizers, softeners, emulsifiers, fats, waxes, flavor oils, and combinations thereof and the second ingredient is selected from the group consisting of hard elastomers, soft elastomers, vinyl polymer elastomers, fillers, antioxidants, and combinations thereof.

7. The method of claim 1 where the first and second ingredients are spray congealed to form the combined ingredient.

8. The method of claim 7 wherein the first ingredient is selected from the group consisting of fats, waxes, emulsifiers, softeners, flavor oils, and combinations thereof and the second ingredient is selected from the group consisting of antioxidants, particulate flavoring agents, neutraceuticals, pharmaceuticals and combinations thereof.

9. The method of claim 1 wherein the antitack ingredient is selected from the group consisting of fats and waxes.

10. A method of making a gum product comprising tabletizing the particulate gum base of claim 1.

11. The method of claim 1 wherein the combined ingredient is formed by into a particulated, free-flowing form by being solidified and then size-reduced.

12. The method of claim 1 wherein the combined ingredient is formed into particulated, free flowing form by being subdivided in a liquid state and then solidified.

13. The method of claim 1 wherein the blending is carried out at a temperature in the range of 50-75°F.

14. The method of Claim 6 wherein the liquid gum base ingredient is selected from the group consisting of vegetable oil lecithin, glycerol triacetate, acetalated monoglycerides, medium chain monoglycerides and vegetable oils.

15. A method of making a particulate blend gum base that uses soft elastomers comprising the steps of:

a) melting a soft elastomer and an elastomer plasticizer together to form a homogeneous molten mixture;

b) cooling and processing the homogenous molten mixture to form a solid mixture in a particulated state; and

c) blending the particulated soft elastomer/elastomer plasticizer with other gum base ingredients to form said gum base.

16. The method of claim 15 wherein the soft elastomer is selected from the group consisting of polybutenes having an average molecular weight from about 5,000 to less than about 30,000, polyisobutylenes having an average molecular weight from about 30,000 to less than about 75,000 and mixtures thereof.

17. The method of claim 15 wherein the molten mixture is cooled to a solid and pulverized to form the particulated state.

18. The method of claim 15 wherein the molten mixture is atomized and then cooled to a solid form.

19. The method of claim 18 wherein said molten mixture has a viscosity of less than 80,000 centipoises at about 250°F.

20. The method of claim 15 wherein the elastomer plasticizer is selected from the group consisting of natural rosin esters, glycerol ester of partially hydrogenated rosin, glycerol ester of polymerized rosin, glycerol ester of partially dimerized rosin, glycerol ester of rosin, glycerol ester of tall oil rosin, pentaerythritol esters of partially hydrogenated rosin, partially hydrogenated methyl esters of rosin, pentaerythritol ester of rosin, synthetic elastomer plasticizers, terpene resins derived from alpha-pinene, beta-pinene and d-limonene and mixtures thereof.

21. A method of making a particulate blend gum base that uses at least one soft elastomer comprising the steps of:

a) melting at least one soft elastomer and at least one polyvinyl acetate together to form a homogeneous molten mixture;

b) cooling and processing the homogenous molten mixture to form a solid mixture in a particulated state; and

c) blending the particulated soft elastomer/polyvinyl acetate with other gum base ingredients to form said particulate blend gum base.

22. The method of claim 21 wherein the soft elastomer is selected from the group consisting of polybutenes having an average molecular weight from about 5,000 to less than about 30,000, polyisobutylenes having an average molecular weight from about 30,000 to less than about 75,000 and mixtures thereof.

23. The method of claim 21 wherein the molten mixture is cooled to a solid and pulverized to form the particulated state.

24. The method of claim 21 wherein the molten mixture is atomized and then cooled to a solid form.

25. The method of claim 24 wherein the molten mixture has a viscosity of less than about 80,000 centipoises at about 250° F.

26. A method of making a particulate blend gum base comprising:

a) providing a fat and a wax;

b) mixing the fat and the wax together in a molten state;

c) cooling the fat and wax blend and forming a particulate material; and

d) blending the fat and wax particulate material with other particulated gum base ingredients to form the particulate blend gum base.

27. The method of claim 26 wherein the particulate fat and wax material has a median particle size of less than about 1 mm.

28. The method of claim 26 wherein the particulate fat and wax material has a median particle size of less than about 0.6 mm.

29. The method of claim 26 wherein the particulate fat and wax material has a median particle size of less than about 425 microns.

30. The method of claim 26 wherein the fat is selected from the group consisting of fully saturated oils that contain, as one or more of their constituent groups, fatty acids of carbon chain length of from 6 to 18 and triglycerides having a total summated saturated caprioic, caprylic, capric, lauric, myristic and palmitic fatty acid content of from about 8 to about 60 percent by weight of the fatty acids, determined from the fatty acid methyl ester distribution by gas chromatography.

31. The method of claim 26 wherein the wax is selected from the group consisting of petroleum waxes containing predominantly iso-alkanes having a carbon chain length greater than about 30, and synthetic waxes.

32. A method of combining a fat and wax to form an ingredient that can be used to make a particulate blend gum base comprising the steps of:

a) providing a fat selected from the group consisting of fully saturated oils that contain, as one or more of their constituent groups, fatty acids of carbon chain length of from 6 to 18 and triglycerides having a total summated saturated caprioic, caprylic, capric, lauric, myristic and palmitic fatty acid content of from about 8 to about 60 percent by weight of the fatty acids, determined from the fatty acid methyl ester distribution by gas chromatography;

b) providing a wax selected from the group consisting of petroleum waxes containing predominantly iso-alkanes having a carbon chain lengths greater than about 30, and synthetic waxes.;

c) melting the fat and wax together to form a melted fat and wax blend;

d) cooling the melted fat and wax blend to form a particulated gum base ingredient.

33. The method of claim 32 wherein the particulate material is formed after cooling the combination to solidify it.

34. The method of claim 32 wherein the melted fat and wax are sprayed as a blended molten mixture and cooled to form spray congealed particles.

35. The method of claim 34 wherein the particles have a mean particle size of less than about 1 mm.

36. The method of claim 34 wherein the particles have a mean particle size of less than about 0.6 mm.

37. The method of claim 34 wherein the particles have a mean particle size of less than about 425 microns.

38. The method of claim 32 further comprising the step of adding an anti-caking agent to the combined fat and wax ingredient to prevent agglomeration.

39. The method of claim 38 wherein the anti-caking agent is selected from the group consisting of fillers, bulk sweeteners, glycerol monostearate and elastomer plasticizers.

40. The method of claim 38 wherein the anti-caking agent is added at a level of between about 0.5% and about 80% of the total weight of the ingredient.

41. The method of claim 38 wherein the anti-caking agent is added at a level of between about 0.5% and about 10% of the total weight of the ingredient.

42. A method of preparing a particulate blend gum base comprising the steps of:

a) melting a gum base ingredient;

b) spraying the melted gum base ingredient through an atomizing nozzle and cooling the ingredient to form a solid, particulated gum base ingredient; and

c) blending the particulated gum base ingredient with other particulated gum base ingredients to form the particulate blend gum base.

43. The method of claim 42 wherein at least one of the other particulated gum base ingredients is pulverized.

44. The method of claim 42 wherein the gum base ingredient that is melted is selected from the group consisting of elastomer plasticizes, microcrystalline and parafin waxes, fully hydrogenated fats and emulsifiers.

45. The method of claim 42 wherein a second ingredient is mixed into the melted gum base ingredient prior to spraying the melted gum base ingredient through the atomizing nozzle.

46. The method of claim 45 wherein the second ingredient is a gum base ingredient.

47. The method of claim 45 wherein the second ingredient is a chewing gum ingredient.

48. The method of claim 45 wherein the second ingredient is an active agent.

49. A method of making a particulate blend gum base comprising the steps of:

a) blending two or more gum base ingredients together in a liquid form to form a combined ingredient; said combined ingredient having a viscosity of less than 80,000 centipoises at about 250° F.;

b) solidifying the combined ingredient in a particulated form; and

c) blending the particulated combined ingredient with at least one other gum base ingredient to form the particulated blend gum base.

50. The method of claim 49 wherein the combined ingredient is solidified in a particulated form by being atomized in a liquid form and then solidified.

51. A method of making a particulate blend gum base comprising the steps of:

a) providing a first gum base ingredient having a softening point greater than 130°F;

b) providing a second gum base ingredient;

c) melting and blending said at least first gum base ingredient with said second gum base ingredient to form a combined ingredient having a liquid form;

d) spraying said combined ingredient to form an atomized spray;

e) hardening said atomized spray to form a combined ingredient that is then used to make said particulated blend gum base.

52. The method of claim 51 wherein the second ingredient has a softening point of less than 130°F.

53. The method of claim 51 wherein the second ingredient is a liquid at 75°F.

54. The method of claim 51 wherein the second ingredient comprises solid particles with a particle size of 0.6 millimeters or less.

55. The method of claim 51 wherein the first gum base ingredient is selected from the group consisting of elastomer plasticizers, hydrogenated fats, waxes and emulsifiers, each having a softening point of greater than 130°F.

56. The method of claim 54 wherein said second gum base ingredient is selected from the group consisting of nutraceuticals,

pharmaceuticals, powdered flavoring agents, high-intensity sweeteners and deoiled lecithins.

57. A method of making a particulate gum base comprising the steps of:

a) providing a first gum base ingredient that has viscosity greater than about 80,000 centipoises at 250° F;

b) providing a second gum base ingredient;

c) blending and melting said at least said first and second gum base ingredients to form a combined ingredient having a viscosity less than about 80,000 centipoises at 250° F.;

d) spraying said combined ingredient to form an atomized spray;

e) hardening said atomized spray to form an ingredient that is then used to make said particulate blend gum base.

58. The method of claim 57 wherein said first gum base ingredient is a polyvinyl acetate having a molecular weight greater than 5000.

59. The method of claim 57 wherein the second ingredient has a softening point of less than 130°F.

60. The method of claim 57 wherein the second ingredient is a liquid at 75°F.

61. The method of claim 57 wherein the second ingredient comprises solid particles with a particle size of 0.6 millimeters or less.

62. The method of claim 57 wherein the second gum base ingredient is selected from the group consisting of elastomer plasticizers, hydrogenated fats, waxes and emulsifiers.

63. The method of claim 61 wherein said second gum base ingredient is selected from the group consisting of neutraceuticals,

pharmaceuticals, powdered flavoring agents, high-intensity sweeteners and deoiled lecithins.

64. The method of claim 57 wherein the combined ingredient is sprayed into a refrigerated atmosphere.

65. A method of preventing agglomeration of one or more particulate gum base ingredients comprising the steps of:

a) providing a plurality of particulate gum base ingredients;

b) blending the plurality of particulate gum base ingredients; and

c) adding an anti-caking agent to the blend of particulate gum base ingredients at a level sufficient to prevent the blend of particulate gum base from agglomerating when left unagitated at a temperature of at least 58º F. for a period of at least about 48 hours.

66. The method of claim 65 wherein the anti-caking agent is selected from the group consisting of fillers, bulk sweeteners, glycerol monostearate, elastomer plasticizers, fumed silica and mixtures thereof.

67. The method of claim 65 wherein the anti-caking agent is glycerol monostearate, and is added to the blend at a level of between about 5% and about 20% of the total weight.

68. The method of claim 65 wherein the anti-caking agent is a filler and the filler is added to the blend at a level of up to about 70% of the total weight.

69. The method of claim 65 wherein the anti-caking agent is a filler selected from the group consisting of calcium carbonate, magnesium carbonate, ground limestone, silicates, zirconium silicate, clay, alumina, talc, titanium oxide, mono- di- and tricalcium phosphate, cellulose polymers and mixtures thereof.

70. The method of claim 65 wherein the anti-caking agent comprises a sugar sweetener selected from the group consisting of sucrose, dextrose, maltose, dextrin, dried invert sugar, fructose, levulose, galactose, corn syrup solids and combinations thereof and is added to the blend at a level of up to about 80% of the total weight.

71. The method of claim 65, wherein the anti-caking agent comprises a sugarless sweetener selected from the group consisting of sorbitol, mannitol, xylitol, hydrogenated starch hydrolysates, maltitol and combinations thereof and is added to the blend at a level of up to about 80% of the total weight.

72. The method of claim 65 further comprising the step of maintaining the blend of particulate gum base ingredients in an environment with a relative humidity of 35% or less.

73. The method of claim 65, wherein the anti-caking agent comprises a fumed silica and is added to the blend at a level of between about 0.5% and about 2% of the total weight.

74. The method of claim 65 wherein the anti-caking agent is an elastomer plasticizer selected from the group consisting of natural rosin esters, glycerol ester of partially hydrogenated rosin, glycerol ester of polymerized rosin, glycerol ester of partially dimerized rosin, glycerol ester of rosin, glycerol ester of tall oil rosin, pentaerythritol esters of partially hydrogenated rosin, partially hydrogenated methyl esters of rosin, pentaerythritol ester of rosin, synthetic elastomer plasticizers, terpene resins derived from alpha-pinene, beta-pinene and d-limonene and mixtures thereof and is added to the blend at a level of between about 0.5% and about 20% of the total weight.

75. A method of preventing agglomeration of one or more particulate gum base ingredients comprising the steps of:

a) providing a plurality of particulate gum base ingredients;

b) blending the plurality of particulate gum base ingredients; and

c) agitating the blend of particulate gum base ingredients until just prior to the addition of the blend of particulate gum base ingredients to a gum mixer.

76. A method of manufacturing gum base so as to have a high degree of consistency from one batch to the next comprising the steps of:

a) providing gum base ingredients in a particulate form;

b) particulate blending the gum base ingredients together without forming a molten gum base to form a first batch of particulate blend gum base; said first batch of particulate blend gum base having a first ash content, a first antioxidant content and a first softening point;

c) repeating steps a) and b) to form a second batch of particulate blend gum base; said second batch of particulate blend gum base having a second ash content, a second antioxidant content and a second softening point;

d) wherein said first ash content and said second ash content have a variation of about 5% or less.

77. The method of claim 76 wherein said first antioxidant content and said second antioxidant content have a variation of about 5% or less.

78. The method of claim 76 wherein said first softening point and said second softening point have a variation of about 5% or less.

79. A method of manufacturing a first gum base having a first composition and subsequently manufacturing a second gum base having a second composition, using the same equipment and minimizing the amount of the first composition carried over into the second composition between the manufacture of the first gum base and the second gum base comprising the steps of:

a) providing a plurality of first gum base ingredients in particulate form;

b) providing a plurality of second gum base ingredients in particulate form;

c) adding the plurality of first gum base ingredients to a mixer, particulate blending the plurality of first gum base ingredients to form a particulate blend of first gum base ingredients and emptying the particulate blend of first gum base ingredients out of the mixer; said mixer retaining a residual amount of first gum base ingredients of less than about 1% of the volume of the mixer; and

d) adding the plurality of second gum base ingredients to the mixer and powder blending the ingredients to form the second gum base.

80. The method of claim 79 wherein the mixer is a "V" shaped powder blender.

81. A method of making a particulate gum base from a plurality of gum base ingredients in a particulate form comprising the steps of:

a) providing a plurality of storage compartments each storing at least one of said plurality of gum base ingredients in a particulate form;

b) providing automated controls to allow remote control dispensing of said at least one of said plurality of gum base ingredients in a particulate form from each of said storage compartments;

c) selecting a gum base to be made;

d) remotely activating said controls to dispense a desired amount of each of said at least one of said plurality of gum base ingredients in a particulate form from said plurality of storage compartments; and

e) blending the desired amounts of the plurality of gum base ingredients in particulate form to form a particulate blend gum base.

82. The method of claim 81 wherein the ingredients are dispensed onto a conveyor by which they are conveyed to a powder blender.

83. The method of claim 81 wherein all of the ingredients for one batch of gum base are dispensed into one collecting container which is then used to transport the ingredients to a powder blender.

84. The method of claim 81 wherein a computer has a plurality of gum base recipes stored therein and signals the controls to said plurality of dispense gum base ingredients in particulate form based on a selected one of said recipes stored in the computer.

85. The method of claim 81 wherein at least some of the storage compartments are equipped with agitators to maintain the at least one gum base ingredient in particulate form stored therein in a free-flowing state.

86. The method of claim 81 wherein at least one of the storage compartments houses a pulverized hard elastomer pre-blended with an elastomer plasticizer.

87. The method of claim 81 wherein said storage compartment comprises a storage container.

88. A method of making a batch of gum comprising the steps of:

a) providing one or more containers that contains pre-weighed amounts of a plurality of gum base ingredients sufficient to form one batch of gum, the plurality of gum base ingredients being in a particulate form;

b) emptying the entire contents of said one or more containers into a gum mixer;

c) adding additional gum ingredients to the gum mixer sufficient to form one batch of gum; and

d) mixing the gum base ingredients and additional gum ingredients to form a batch of gum.

89. The method of claim 88 wherein each of the containers of gum base ingredients further comprises an anti-caking agent.

90. The method of claim 89 wherein said batch of gum has said anti-caking agent dispersed throughout.

91. The method of claim 88 wherein the one or more containers each comprises a bag.

92. The method of claim 88 wherein the gum base ingredients in the one or more containers are homogeneously blended together before being placed in the containers.

93. The method of claim 88 wherein the gum base ingredients are mixed together in the mixer prior to the addition of any of the additional gum ingredients to the mixer.

94. The method of claim 88 wherein the additional gum ingredients are added to the mixer prior to when the one or more containers of gum base ingredients are emptied into the mixer.

95. The method of claim 88 wherein the particulate gum base ingredients in the one or more containers are in the form of a free-flowing powder.

96. The method of claim 88 wherein the gum base ingredients in the one or more containers are at least partially agglomerated .

97. The method of claim 88 wherein all of the base for one batch of gum is contained in one container.

98. A method of manufacturing gum comprising the steps of:

a) providing a plurality of particulated gum base ingredients;

b) providing additional gum ingredients;

c) adding a combination of the particulated gum base ingredients to a gum mixer as a particulate blend; the gum mixer having an initial kettle temperate of between about 20° C. and about 40° C.;

d) adding the additional gum ingredients to the mixer;

e) mixing the combination of the particulated gum base ingredients and additional gum ingredients in the gum mixer to form a gum composition.

99. The method of claim 98 wherein the gum mixer is a continuous mixer.

100. The method of claim 98 wherein the gum composition is manufactured in batches.

101. The method of claim 98 wherein the particulated blend of the plurality of particulated gum base ingredients is prepared at the same facility as where the blend is used.

102. The method of claim 98 wherein the gum mixer is a low efficiency mixer.

103. The method of claim 98 wherein the combination of the particulated gum base ingredients and the gum ingredients are added at the same time to the mixer.

104. The method of claim 98 wherein the combination of the particulated gum base ingredients includes a pre-blend of elastomer, elastomer plasticizer and filler.

105. The method of claim 98 wherein the combination of the particulated, gum base ingredients includes a spray congealed blend of gum base ingredients comprising a fat and a wax.

106. The method of claim 105 wherein said spray congealed blend of gum base ingredients further comprises an emulsifier.

107. The method of claim 105 wherein said spray congealed blend of gum base ingredients further comprises at least one flavoring agent.

108. The method of claim 98 wherein the combination of the particulated gum base ingredients includes a spray congealed blend of gum base ingredients comprising at least one gum base ingredient that is a liquid at 75° F.

109. The method of claim 108 wherein said liquid gum base ingredient is selected from the group consisting of vegetable oil lecithin, glycerol triacetate, acetalated monoglycerydes, medium chain monoglycerides and vegetable oils.

110. The method of claim 98 wherein the combination of the particulated gum base ingredients includes a spray congealed blend of gum base ingredients comprising at least one liquid gum base ingredient; said spray congealed blend of gum base ingredients having a viscosity of less than 80,000 centipoises at 250° F.

111. The method of claim 110 wherein said liquid gum base ingredient is molten.

112. A method of claim 98 wherein the mixing of the plurality of particulated gum base ingredients and additional gum ingredients in the gum mixer forms the gum composition within 10 minutes.

113. The method of claim 112 wherein the particulate blend of gum base ingredients includes at least one flavoring agent.

114. The method of claim 112 wherein the additional gum ingredients in the gum mixer includes at least one flavoring agent.

115. The method of claim 98 wherein the particulated gum base ingredients have a mean particle size of about 30 microns.

116. A method of making a gum composition using reduced temperature comprising the steps of:

a) providing gum base ingredients in a particulate form;

b) adding the particulate gum base ingredients to a gum mixer;

c) adding additional gum ingredients to the mixer and mixing all of the ingredients to form the gum composition, the contents of the mixer not exceeding a temperature of 120° F. throughout the mixing process.

117. A method of making chewing gum comprising the steps of:

a) providing at least one first gum base ingredient having a softening point of less than about 130° F;

b) providing a second ingredient that is used to make chewing gum;

c) combining at least said first gum base ingredient and said second gum ingredient to form a combined ingredient having a particulated form; and

d) combining the combined ingredient with at least a third gum ingredient to form a chewing gum composition.

118. The method of claim 117 wherein the combined ingredient has a softening point intermediate of the softening points of the first and second ingredients.

119. The method of claim 117 wherein the second ingredient is used to encapsulate the first ingredient.

120. The method of claim 117 wherein the first and second ingredients are spray congealed to form the combined ingredient.

121. The method of claim 117 wherein the second gum ingredient is selected from the group consisting of bulk sweeteners, high-intensity sweeteners, flavoring agents and combinations thereof.

122. A method of making a chewing gum composition that contains a temperature sensitive ingredient comprising:

a) providing a particulate blend gum base;

b) adding the particulate blend gum base to a gum mixer;

c) adding other gum ingredients, including said temperature sensitive ingredient, to the gum mixer and mixing the ingredients to form a chewing gum composition, the temperature sensitive ingredient being mixed into the other ingredients earlier in the mixing process than when the temperature sensitive ingredient is conventionally mixed into the chewing gum composition made using a melted gum base.

123. The method of claim 122 wherein the temperature sensitive ingredient is selected from the group consisting of active agents, antioxidants, flavors, high-intensity sweeteners, and combinations thereof.

124. The method of claim 122 wherein the temperature sensitive ingredient is added to the mixer prior to the addition of the powder blend gum base.

125. An improved method of making a gum composition wherein the improvement comprises using a gum base in a particulate blend form and mixing the gum for less time than would be used to make the same gum composition using a gum base having the same composition as the particulate blend but in a melted state.

126. A method of making a gum composition that contains a temperature sensitive ingredient comprising:

a) providing a particulate blend gum base;

b) adding the particulate blend gum base to a gum mixer;

c) adding other gum ingredients, including said temperature sensitive ingredient, to the gum mixer and

d) mixing the ingredients, including said temperature sensitive ingredient, for a period of time to form a gum composition; said period of time being shorter than the period of time required to mix a conventional gum composition using a melted gum base.

127. A method of making a gum composition that contains a temperature sensitive ingredient comprising:

a) providing a particulate blend gum base;

b) adding the particulate blend gum base to a gum mixer;

c) adding other gum ingredients, including said temperature sensitive ingredient, to the gum mixer and mixing the ingredients including said temperature sensitive ingredient, to form a gum composition; the temperature sensitive ingredient being mixed into the other ingredients with the initial addition of gum ingredients in the mixing process.

128. The method of claim 127 further comprising the step of tabletizing said gum composition to form a tabletized gum.

129. The method of claim 127 wherein the temperature sensitive ingredient is selected from the group consisting of active agents, flavor oils, powdered flavors, high-intensity sweeteners, pharmaceuticals and nutraceuticals.

130. A method of making a gum composition using reduced temperature comprising the steps of:

a) providing gum base ingredients in a particulate blend form;

b) adding the particulate blend gum base ingredients to a gum mixer having an initial kettle temperature of between about 20° C. and about 40° C.;

c) adding additional gum ingredients to the mixer and mixing all of the ingredients to form the gum composition.

131. A method of making a gum composition and wrapping gum products made therefrom without the need to condition the gum composition prior to wrapping, comprising the steps of:

a) using a particulate blend gum base to make a gum composition;

b) forming the gum composition into gum sticks; and

c) wrapping the products without conditioning the gum sticks.

132. The method of claim 131 wherein the products are wrapped within less than an hour after being formed from the composition.

133. The method of claim 131 wherein the particulate blend gum base includes at least one ingredient comprising a pre-blend of an elastomer and elastomer plasticizer, but wherein the pre-blend has been blended for a period of time of less than 20 minutes.

134. The method of claim 133 wherein the pre-blend has been blended for less than 15 minutes.

135. The method of claim 133 wherein the pre-blend has been blended for about 10 minutes or less.

FIG. 1

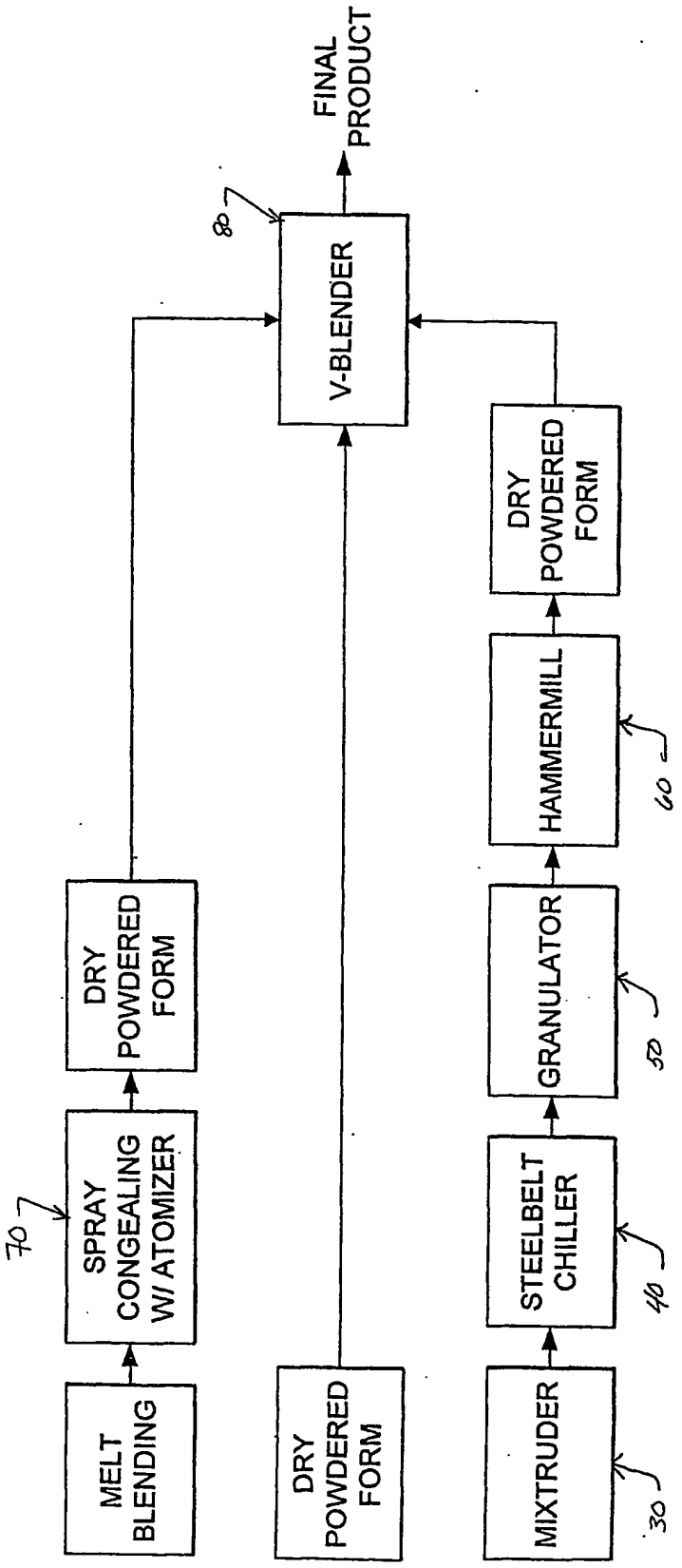

10
FINAL PRODUCT
80
V-BLENDER
DRY POWDERED FORM
HAMMERMILL
60
DRY POWDERED FORM
GRANULATOR
50
STEELBELT CHILLER
40
MIXTRUDER
30
DRY POWDERED FORM
70
SPRAY CONGEALING W/ ATOMIZER
MELT BLENDING

FIG. 2

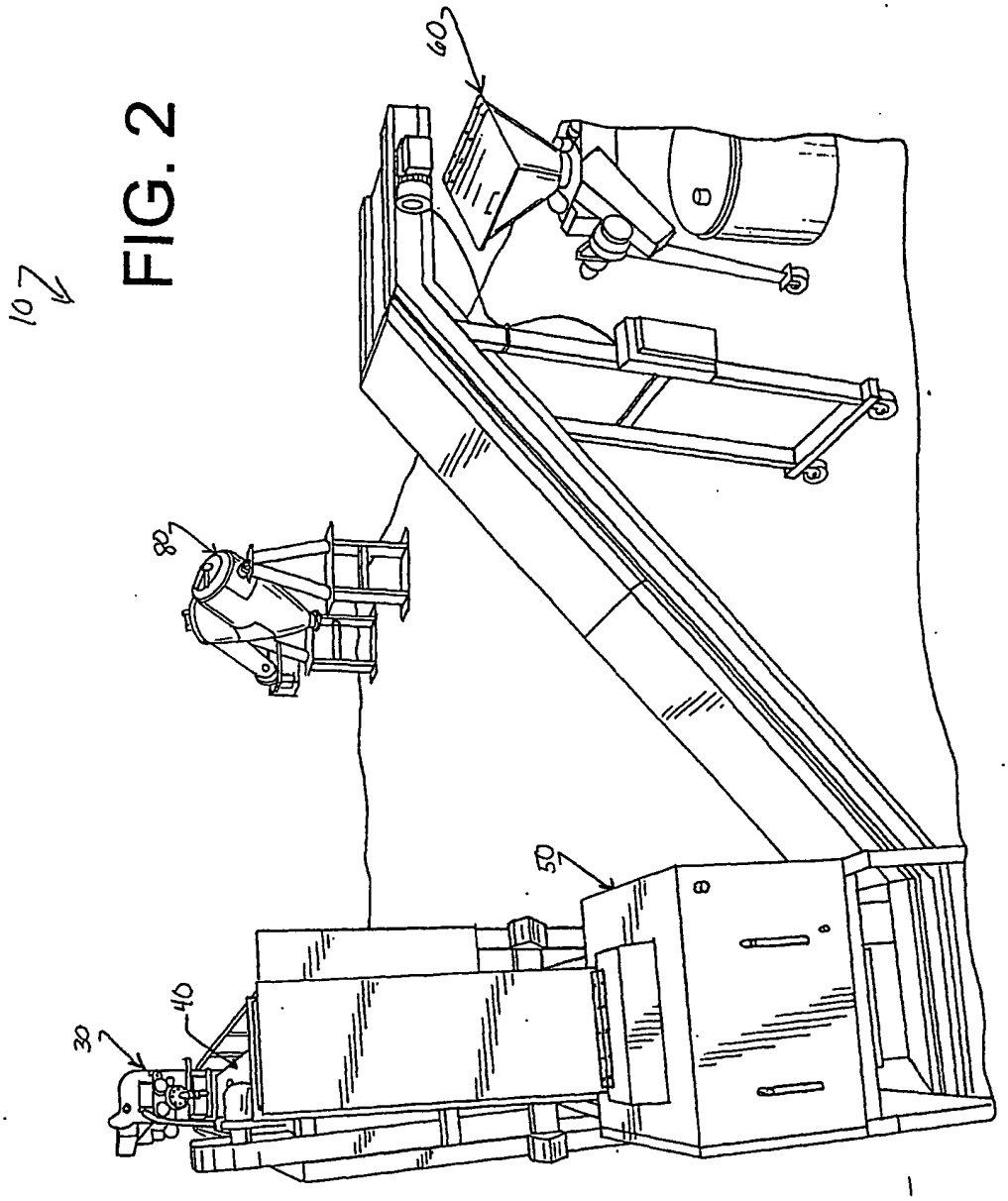


FIG. 3

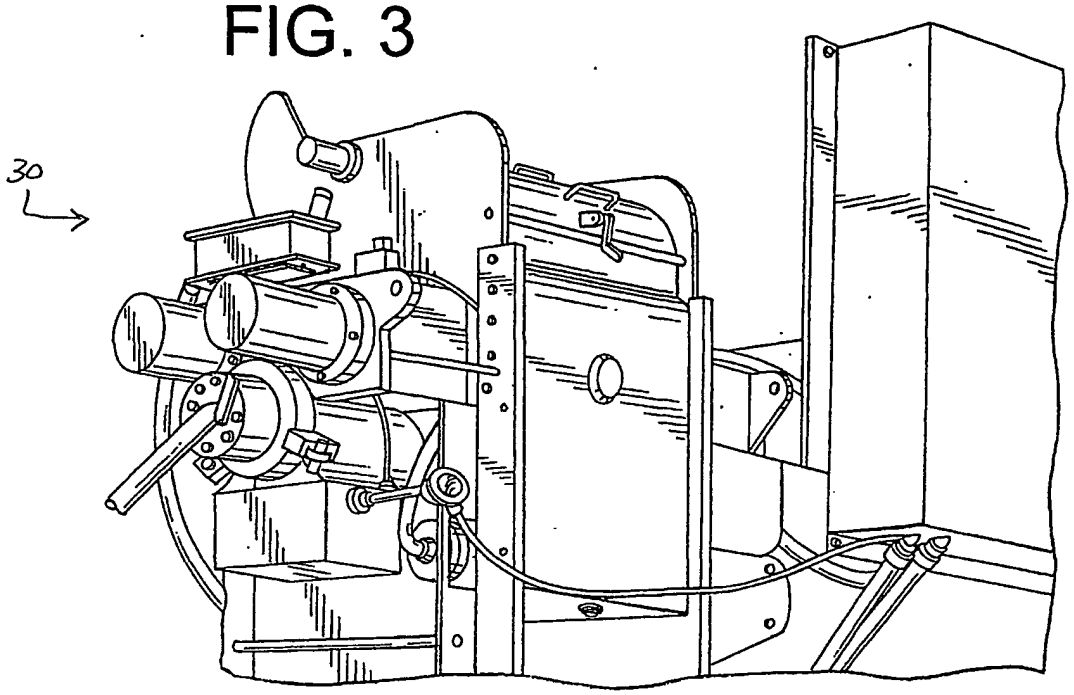


FIG. 4

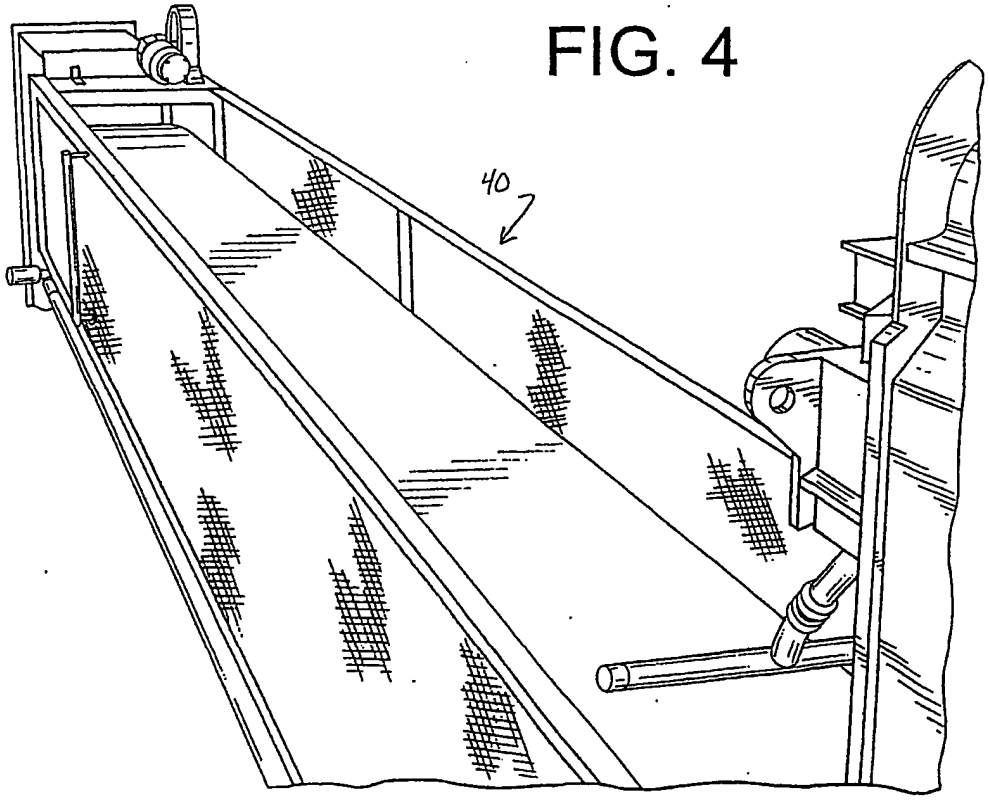
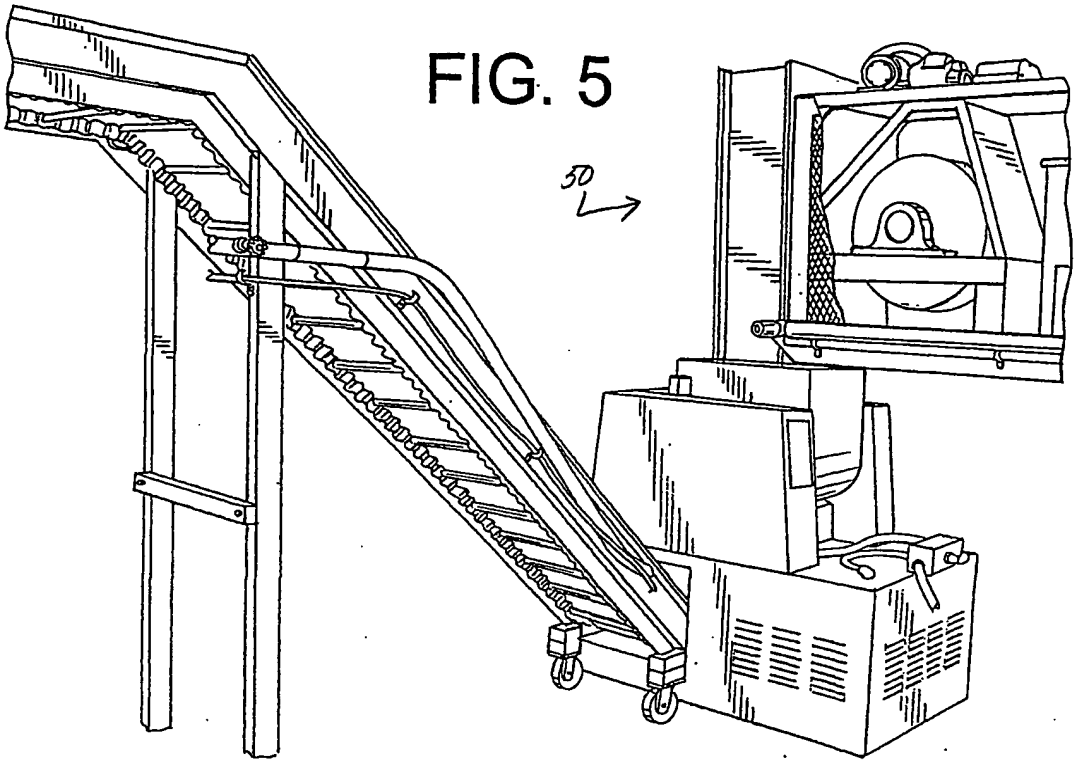


FIG. 5



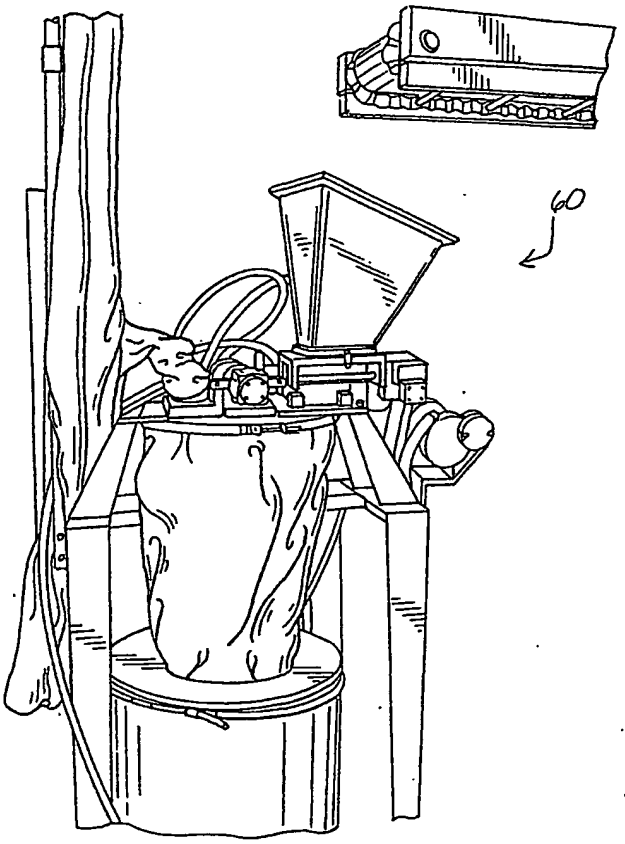
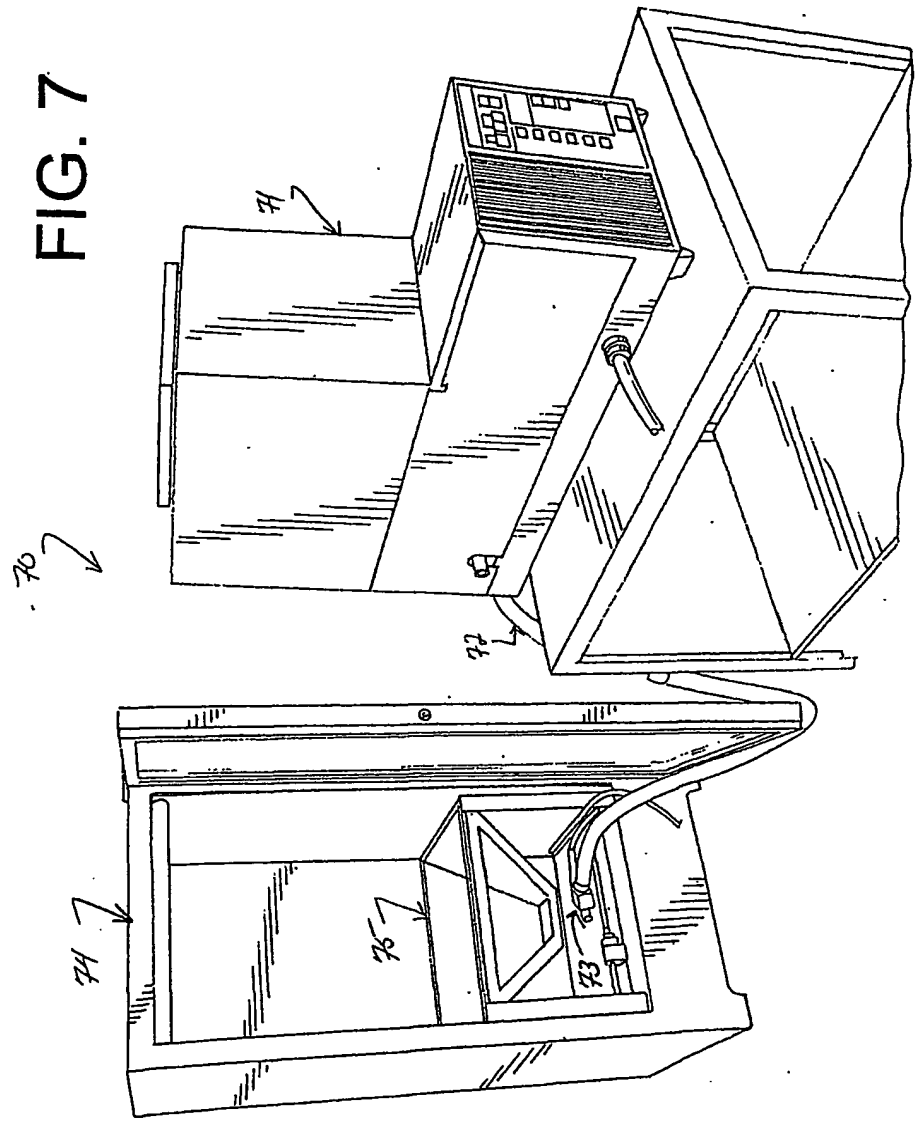


FIG. 6

FIG. 7



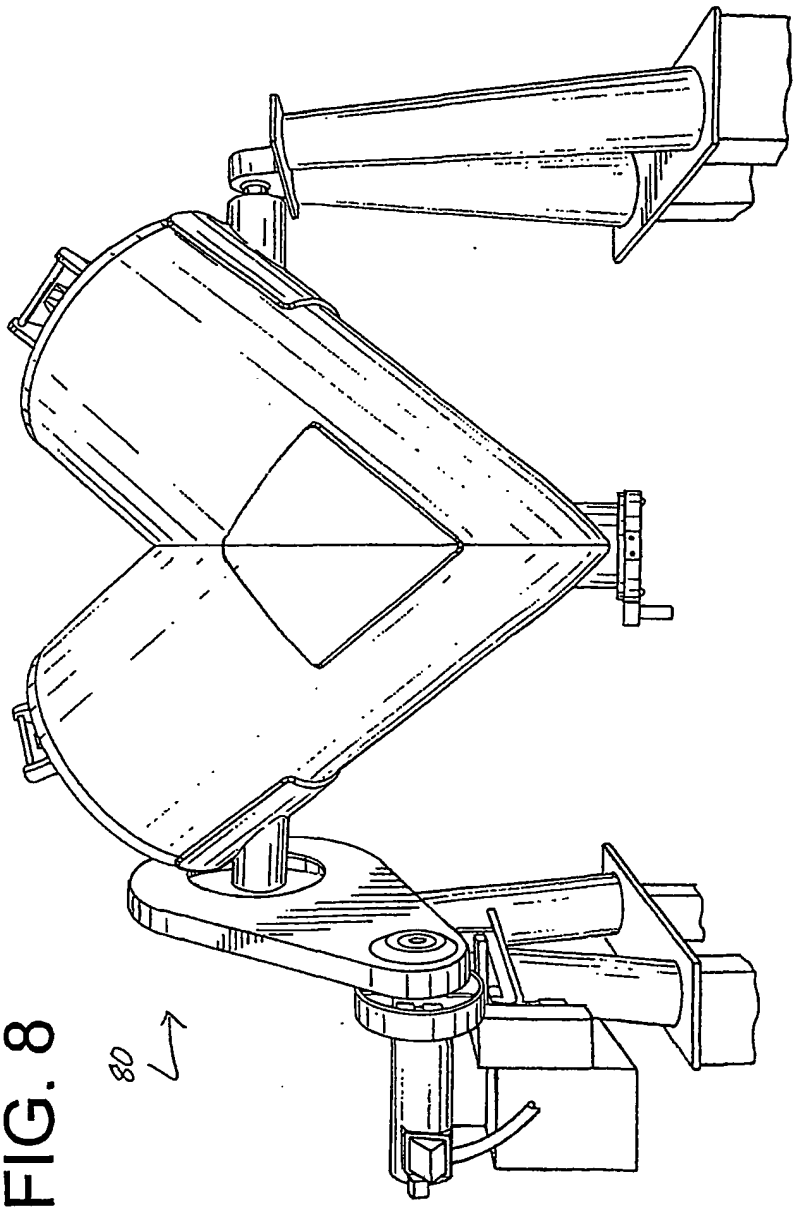


FIG. 8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US01/07075

A. CLASSIFICATION OF SUBJECT MATTER
IPC(7) : A23G 3/30, 1/00; A23C 9/00; A23B 4/03, 4/044
US CL : 426/4; 426/285; 426/454
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
U.S. : 426/4; 426/285; 426/454

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,958,471 A (SCHWARZ et al) 28 September 1999 (28.09.1999), See entire document.	Claims 1-135
X	WO 86/03967 A1 (GERGELY et al) 17 July 1986 (17.07.1986), See Abstract	Claims 1-135

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search
31 August 2001 (31.08.2001)

Date of mailing of the international search report
14 DEC 2001

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